POWER PLANT ENGINEERING

Established Over 36 Years

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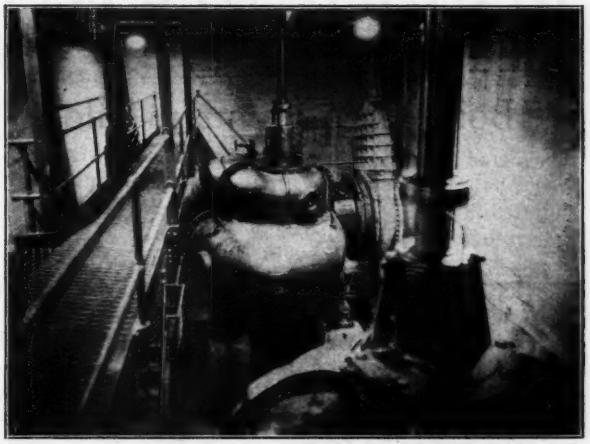


They Draw a Lot of Water

BECAUSE of its well known tendency to rust iron, water does not, in some sections of the country receive the plaudits which it rightly deserves. Say what you will, water makes the modern power industry possible and the Allis-Chalmers pumps shown above draw a lot of this water and do their share in helping supply a large block of the power that has made this country the envy of the world.

Now, like water, machinery manufacturers of this country have played a necessary part in the industry's growth. In fact without them the country would still be back in the days when engines and boilers were turned out in the local machine shop.

By keeping a jump ahead of what engineers as a whole are doing, the manufacturers have carried the power industry ahead by leaps and bounds. Since last year many new developments have taken place. Some big, some small but each one made in response to a definite need.

The importance of these developments, has so far exceeded that of previous years that we have found it necessary to devote an entire issue to this march of progress, these pages being in addition to the new equipment pages of each issue throughout the year. After looking over some of the advances it is easy to see why the wide-awake manufacturers draw a lot of water in our industry. They make industrial progress possible.

For your convenience this equipment has been grouped under six general headings such as boilers, p. 58; auxiliaries, p. 71; prime movers, p. 83; instruments, p. 88 electrical, p. 93; and maintenance, heating and ventilating, p. 97.

MAJOR NEW EQUIPMENT *for the* MODERN BOILER ROOM

Boilers, Economizers and Superheaters

BABCOCK & WILCOX CO.
NEW YORK, N. Y.

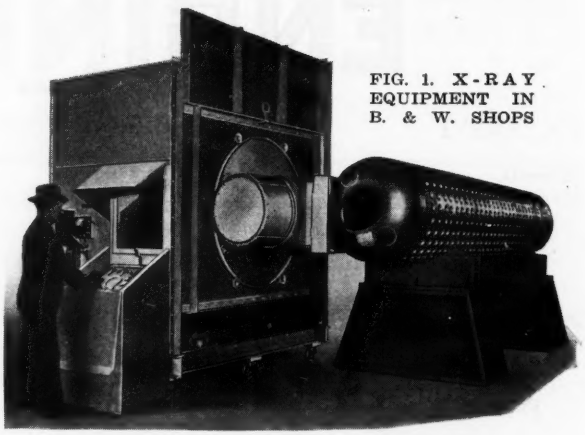


FIG. 1. X-RAY EQUIPMENT IN B. & W. SHOPS

AMONG THE MANY important developments of 1931, none is of more immediate importance than the admission of fusion welded boiler drums to the boiler code. As of November 1, 1931, The Babcock & Wilcox Co., had delivered or had under construction 150 fusion-welded power boiler drums.

These drums with fusion welded seams are for installations in thirteen states, in one territory and in ships of the United States Navy. The boilers will serve twelve entirely different industries and will operate at pressures from 150 to 500 lb. per sq. in.

The Babcock & Wilcox Company has equipped its shops with modern automatic arc welding machines, powerful X-ray apparatus shown in Fig. 1 and one of the largest annealing furnaces ever built. These, and complete laboratory facilities for comprehensive tests of welds, enable the company to supply all of its boiler drums with fusion welded seams.

HIGH TEMPERATURE SUPERHEATER

During the first part of the year 1931, this company built an experimental, separately-fired superheater, Fig. 2, for the Delray Station of the Detroit Edison Co. The unit is designed to heat 90,000 lb. of steam per hour from a temperature of 700 deg. F. to 1100 deg. F. at a pressure of 400 lb. per sq. in. It is built in three sections, one radiant and two convection, which are arranged for parallel and contra flow of the steam and the hot gases. Oil is used as fuel. Since the burners were first lighted in July, the unit has been supplying from 20,000 to 90,000 lb. of steam per hour and has been operating satisfactorily.

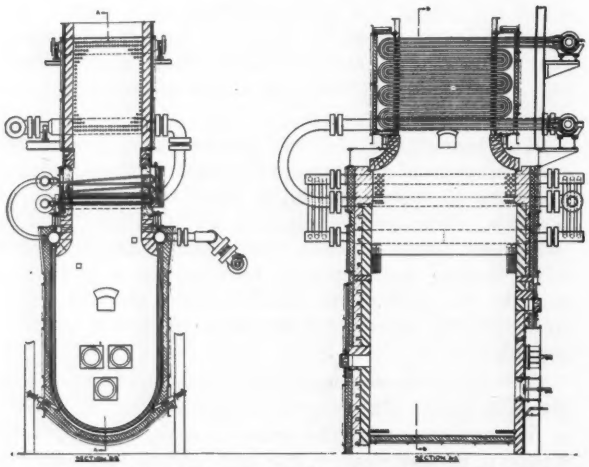


FIG. 2. BABCOCK & WILCOX HIGH TEMPERATURE SUPERHEATER

THE CONTINUOUS TUBE ECONOMIZER

Recently, the company has also developed a continuous-tube, return-bend economizer. This is a development of the return-bend type with flanged fittings but is made in sections each of which is a continuous tube with small radius bends. Each section is joined to that preceding and that following by forged-steel removable return bends. The sections are supported at the ends by removable steel bars. Long spans are supported at the center by a welded, integral truss construction.

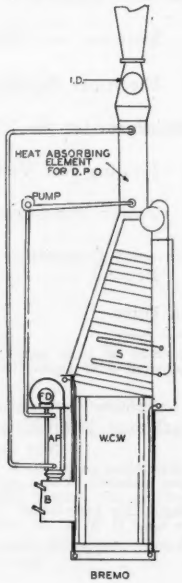


FIG. 3. SINGLE PASS BABCOCK & WILCOX BOILER INSTALLED IN THE BREMO STATION INCORPORATE NEW FEATURES OF DESIGN AND CONSTRUCTION

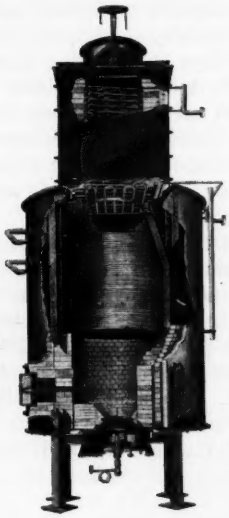


FIG 4. A 3500-LB. BABCOCK & WILCOX BOILER FOR EXPERIMENTAL PURPOSES AT PURDUE UNIVERSITY

The Single Pass Boiler

Two boilers of a new type were furnished by the company during the year 1931, for the Bremo Station of the Virginia Public Service Co. These were the first units of their kind to be built and incorporate new features of design and practice.

Each unit is high and narrow and arranged for a single, vertical pass of the flue gases between the furnace and the stack as shown by Fig. 3. The uptake headers are inclined, forming a converging gas passage through the boiler to maintain a nearly uniform velocity of the gas as its temperature decreases. The boiler has three decks of inclined tubes with a Babcock & Wilcox interdeck superheater placed between the lower and middle decks. A unit of this type has a low draft loss, occupies a minimum of floor space and is capable of operating at high capacities.

High Pressure Series Boiler

Another important piece of equipment is a small, experimental series boiler designed and built by the company for the engineering experiment station at Purdue University to further research on the generation of steam at high pressures. The boiler Fig. 4 was designed for a maximum working pressure of 3500 lb. per sq. in.

A steam drum is not used. The economizer is of the counterflow type and connected directly to the furnace section which is built of two parallel continuous tubes wound in the form of a cylindrical helix at the lower part, and a conical helix at the upper. Experimental data have been released in a paper entitled "Characteristics of a High Pressure Series Steam Generator" which is published by the American Society of Mechanical Engineers.

Combustion Engineering Corp., New York, N. Y.

Combustion steam generator, a standard steam generating unit built in various sizes and providing a wide range of capacities at any desired conditions of steam temperature and pressure, is now being offered by Combustion Engineering Corp., New York. Detail designs have been completed for eight sizes with capacities ranging from 70,000 to 400,000 lb. of steam per hour, from and at 212 deg. F.

As shown in the accompanying illustration, this design combines in one unit all the elements required for fuel-burning, steam generation and superheating, heat recovery and ash disposal. Pipes and headers essential for completing the circulating system of water wall are located entirely within the casing, where, in addition to performing their normal function as circulators, they also serve as highly effective heat absorbing surface.

A point of particular interest, is the entire absence of openings through the casing. Such openings, ordinarily required for the ingress and egress of wall tubes and headers, may permit the discharge of dust during soot blowing operations, as well as the inflow of air during normal operation. The steam generator casing is designed to be air-tight and dust-tight throughout.

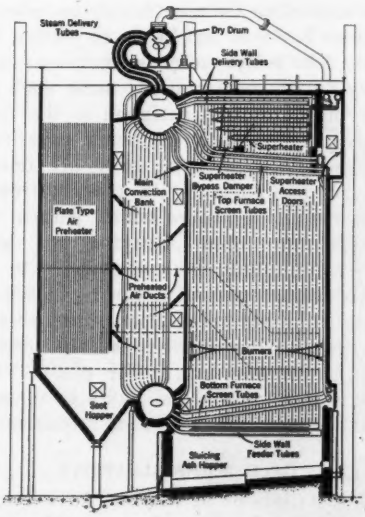
The result of the arrangement of wall tubes and circulators is a furnace built completely of water tubes to the exclusion of exposed refractories and having the maximum attainable quantity of contained water with provision for the highest possible freedom of circulation.

Type of firing used is the corner-tangential system, designed to produce intense turbulence with extreme rapidity of combustion and correspondingly high temperatures, these high temperatures being the result (not the cause) of the high rates of combustion.

A superheater bypass damper is used to afford a means of controlling superheat temperature. Adequate space is provided for the superheater which is so located in the assembly as to permit of simple supports and a degree of accessibility unusual in boiler construction.

Multiple Circulation Boiler

The C-E Multiple Circulation Boiler shown in Fig. 6 is a recent development. A particularly noteworthy feature of these boilers is that every other section of tubes of the front bank is connected to the middle drum and every other section of tubes of the second bank is connected to the front drum. These two systems divide the work of steam liberation from the front bank of tubes between two drums. This gives an advantage in more effective use of the steam volume of the drums above the water line, by minimizing the turbulence in the steam drum, thus increasing the effectiveness of the



ARRANGEMENT OF ELEMENTS OF STEAM GENERATOR

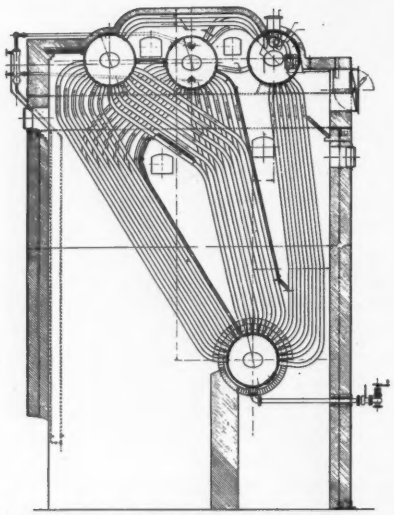


FIG. 6. COMBUSTION ENGINEERING MULTIPLE CIRCULATION BOILER

steam liberating area and resulting in a more even water level and dryer steam at all ratings. The tubes in the front bank, which do the most work enter the front drum near the water line and, consequently, the steam coming from them does not cause as much agitation as occurs when these tubes enter the drum considerably below the water line.

Fusion Welding Equipment

Hedges-Walsh-Weidner Co., an affiliated company, is in a position to furnish boilers for any pressure and for any capacity for which a commercial demand can be foreseen at the present time. The adoption by the A.S.M.E. Code permitting fusion welded boiler drums has raised the pressure limit by a considerable extent for which boilers may be built without resorting to forged drums. This limit is now established by the facilities available for bending the drum plates to form.

The company maintains a laboratory in charge of chemical and metallurgical engineers, equipped with tension testing machines, hardness testing machines, photo-micro apparatus and other necessary equipment for a continual testing and inspection of all welded work. The annealing furnace for stress relieving of the welded drums is 14 ft. by 14 ft. in section and 64 ft. long inside. The length may be increased to 80 ft. as soon as any future requirements make such a demand. This annealing furnace is designed so that the temperature of all parts of the drum being stress-relieved are maintained within a small range at all times.

The X-ray equipment, with tube rectifiers, is provided with two X-ray tubes which permit two simultaneous exposures when X-raying the longitudinal seams. These tubes can be operated up to 250,000 v. and the generating equipment can be increased to provide for higher power tubes when such tubes are available. The penetrating capacity of the present equipment is approximately 4-in. boiler plate. This enables the company to X-ray welded joints in plates approximately 1 in. heavier than the code requirements.

Recent Installations

Several installations of interest have been designed or actually placed in operation recently among them being several units of sufficient capacity to operate large turbines. The fifth boiler unit fired by the Lopulco System of pulverized coal at the Kips Bay Station of the New York Steam Corp., New York City, was placed in operation on November 15, 1930, on the scheduled date, eight months after the contract date. Since starting operation, this unit has been available over 95 per cent of the time and has developed steam at the rate of over 1,000,000 lb. of steam per hour on peak load.

The pulverized fuel installation at the Duluth Steam Electric Station of the Minnesota Power and Light Co., Duluth, Minn. is particularly notable, as there is but one boiler in the plant. This is a single-pass sectional (see Power Plant Engineering p. 837, Aug. 15, 1931) header Walsh & Weidner boiler without baffles and is 38 tubes wide by 40 tubes high. Two single-pass boilers similar to the one in the Duluth plant have been installed in the plant of the West Virginia Hydro-Electric Co., Boncar, W. Va., and will operate without the aid of induced draft fans.

Latest installation for the Milwaukee Electric Railway & Light Co. is at the East Port Washington Station and consists of a 42,400-sq. ft. C-E bent tube boiler which will operate at 1400 lb. pressure, 850 deg. F. and will supply sufficient steam for the generation of 85,000 kw. The C-E Standard Steam Generator at the Solvay Process Co., Solvay, N. Y., (see Power Plant Engineering p. 1053, Nov. 1, 1931), is now operating 24 hr. per day at maximum steam demand. Eight C-E bent tube boilers are being installed at the Hudson Avenue Station of the Brooklyn Edison Co., Brooklyn, N. Y., each having a heating surface of 24,450 sq. ft. These eight boilers will serve two 160,000-kw. turbines.

At Burlington, N. J., the Public Service Electric & Gas Co. is erecting the first of an ultimate of eight units in a new station. This equipment comprises a 29,800-sq. ft. Walsh & Weidner sectional header boiler. The preparation plant is located within the same building immediately in front of the boiler. This system is unique in that the pulverized fuel bin will have only a 4-hr. supply. Installation of C-E Steam Generators at the Johnstown plant of the Bethlehem Steel Co. has created a considerable amount of interest on account of the continuous operation at higher efficiency than has heretofore been obtained with blast furnace gas. The Ford Motor Company has recently placed in operation at the Fordson plant two C-E bent tube boilers of 32,040 sq. ft. of heating surface each with working pressure of 1400 lb. per sq. in. are the largest capacity, high-pressure units so far installed for industrial service.

During 1931, two units each designed for evaporation of 150,000 lb. of steam per hour at 1800 lb. per sq. in. pressure and 819 deg. F. total steam temperature were placed in operation in the plant of The Philip Carey Co. at Lockland, Ohio. Raymond impact mills supply the fuel directly to tangential burners.

Foster Wheeler Corp., New York, N. Y.

Two 508-ft. express liners, the S. S. Santa Paula and the S. S. Santa Elena, now under construction for the Panama Mail Steamship Co., are being equipped with new Foster Wheeler express type marine boilers. These boilers are of the three-drum "A" design; each contains 4900 sq. ft. of heating surface and operates at a pressure of 400 lb. per sq. in. They are equipped with

superheaters, waterwalls and economizers and will burn oil fuel. Four of these boilers will be installed in each vessel.

One of the boilers, set up with stack and accessories for complete tests, has been operated at ratings varying from 10,000 to 40,000 lb. of steam per hour and the final steam temperature has not varied more than 10 deg. over that range.

When installed in the ships, the boilers are expected to produce under normal conditions 35,000 lb. of steam per hour. The boilers are guaranteed for an overall efficiency of 85.67 per cent at this rating and the preliminary tests indicate that even better results will be secured. The high efficiency is attributed to large furnace volume, the proper proportioning of boiler heating surface and the use of 3000 sq. ft. of economizer heating surface.

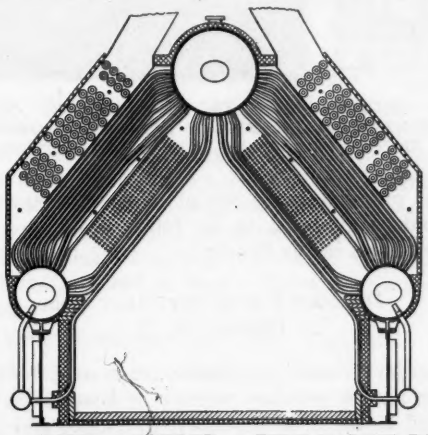


FIG. 7. FOSTER WHEELER, A TYPE MARINE BOILER

THE WICKES BOILER CO.,
SAGINAW, MICH.

The past year marks an outstanding development in the manufacture of steam boiler drums. This development has been made possible by the adoption of rules for fusion welding of power boiler drums and unfired pressure vessels by the A. S. M. E. Boiler Code Committee. The rigid requirements of these Codes assures the user of construction and workmanship which fully meet the standards of safety.

The fact that the seams of boiler drums which have been riveted in the past will now be supplanted with fusion welded construction is of great importance. During the past few years, increased pressures have required the use of plates of great thickness. Large and long rivets through 5 to 6 in. of plate at the butt straps have not been unusual. In new construction fusion welded joints, of equal or greater strength than the parent metal, as required by the A. S. M. E. Fusion Welding Code, are now standard construction with a number of manufacturers. The fabrication of fusion welded power drums is an important advancement in the art of boiler making.

HENRY VOGT MACHINE CO.,
LOUISVILLE, KY.

Boilers are built by the Henry Vogt Machine Co. in three-drum and four-drum designs with curved tubes and of various types to suit special conditions and service. The three drum Class ML or low head type is the latest development and has been installed in practically every industry requiring steam for power, heating, or process purposes. It serves with marked success wherever durability and dependability are required with maximum capacity in limited floor space or head room. Available in sizes from 80 to 425 hp.

All boilers can be arranged for firing with any fuel or fuel burning device. These boilers are built strictly to the A. S. M. E. Codes for either riveted or fusion welded construction and are designed to assure high operating efficiencies and low maintenance costs.

WELDING PRESSURE VESSELS

The Homoweld is a metallurgically complete union, free from all harmful defects such as nitride needles, porosity, cracks, slag inclusions, incomplete fusion, segregations, or other flaws.

Special equipment and a skilled welding technique, developed through twenty years of fusion welding our own products, with constant supervision during fabrication assures maximum strength and serviceability of any Homoweld boiler drum or pressure vessel constructed for the refinery, chemical, or power field.

We fabricate vessels for every pressure and temperature in any size or shape within transportation limits. Such products are fully insurable and comply with all requirements of the A. S. M. E. Code for fusion welding.

ZIER BOILER & SHEET IRON CO.
NEW ALBANY, IND.

VaporiZier is a trade name for a new water tube boiler being built by the Zier Boiler & Sheet Iron Co. This boiler is of vertical design to permit the complete combustion before the flame strikes any surface. The forced draft sends the heat over the baffle wall which extends upward within a foot of the inner top head and back down through the water tubes to two openings at the bottom into the stack. There is an inner corrugated shell with a top head and a bottom head connected with the water tubes; outside consists of heavy plate construction with the top and bottom heads. This gives the VaporiZier a shell completely filled with water, bottom head below fire and top head large with unlimited steam space.

Now being manufactured from 20 hp. to 150 hp., with the combination of the VaporiZier and the Zier under-fed stoker. Installations are sold only as a complete unit consisting of boiler and stoker combined.

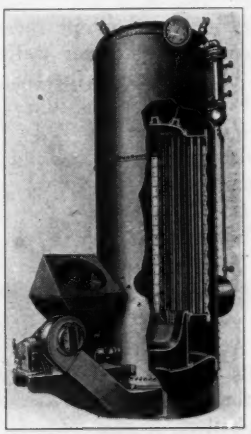


FIG. 8. CUT AWAY VIEW OF THE VAPORIZIER

THE SUPERHEATER CO.
NEW YORK, N. Y.

During the past year, the majority of Elesco superheaters designed or placed in operation were for pressures below 450 lb. per sq. in. Exceptions to this rule which were either designed or placed in operation were:

1—Ford Motor Co.....1400
2—Standard Oil Co. of N. J. (Baltimore)..... 650
3—Solvay Process 825
4—Brooklyn Edison Co. 500
5—West Va. Hydro Electric Co..... 488
6—Public Service Electric & Gas Co..... 728
7—Boston Elevated Ry. Co..... 725
8—The Philip Carey Co.....1840

In the above high pressure installations, only two have exceeded a steam temperature above 750 deg. F, namely, Public Service Electric & Gas Co., which is designed for a maximum temperature of 860 deg. F. and The Philip Carey Co., which is designed for 825 deg. F.

In regard to high temperature, it is interesting to note that special alloy steel tubing was used in the high temperature section. This section of special tubing was joined to the section of low carbon tubing by means of Elesco forged return bends which have already proved themselves so successful. Inquiries have been received by Elesco for integral superheaters for as high as 900 deg. F.

Furnace Walls, Sootblowers and Baffles

AMERICAN ENGINEERING CO.
PHILADELPHIA, PA.

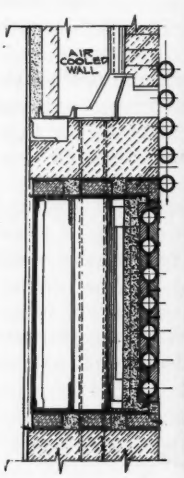
AT THE TIME the stoker installation was made on Beaverhill (see the article on stoker developments following), the rear wall was designed to be covered by American Engineering Co. A-E-Co. Furnace Armor, a protection formed of cast iron blocks fastened on water-cooled tubes. To the best of our knowledge, this was the first attempt ever made to water-cool marine furnace walls. The maintenance on the furnace walls was reduced to a figure negligible compared to that previously experienced with hand-fired watertube boilers in spite of a liberation of 68,000 B.t.u. per cu. ft. of furnace volume at normal load.

SLAG DRIP WATER WALLS

Under severe operating conditions and high burning rates, coals with low fusion temperatures and high sulphur or iron content form slag which flows over and adheres to the water walls. To prevent this flow over the block portion, the "slag drip" construction shown in Figure 1 has developed by introducing one or more bare tubes over the block portion projecting beyond the face of the wall. The effect of the slag drip feature is clearly shown in Fig. 2. The slag drips off the ledge in relatively small amounts formed by the bare tubes and falls into the fuel bed to be carried eventually into the ash pit. This new development is fully covered by patents pending in United States and foreign countries.

FLARED FURNACE WALLS

At one of the large eastern central stations, the side walls instead of being straight were flared out at the bottom to permit the installation of a stoker wider than the boiler.



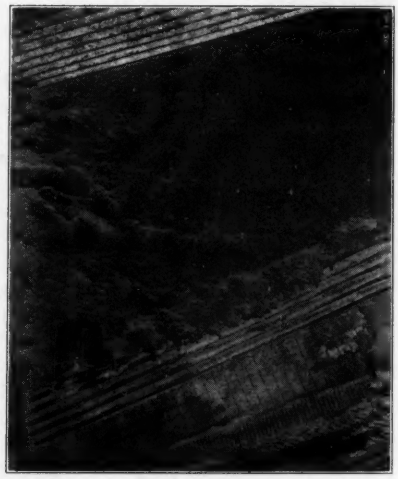


FIG. 1. (LEFT) AMERICAN ENGINEERING CO. SLAG DRIP CONSTRUCTION. FIG. 2. (RIGHT) SHOWING THE EFFECTIVENESS OF THE CONSTRUCTION.

This practice makes use of extra floor space available and is expected to be followed out to a much greater extent in the future.

DIAMOND POWER SPECIALTY CORP.
DETROIT, N. Y.

In order to meet the demand for a mechanical means of cleaning low-pressure water-tube heating boilers, the Diamond Power Specialty Corp. developed and installed during 1931 a number of installations of its A-2 air operated automatic soot blower equipment for low-pressure water-tube boilers. Steam pressure below 50 lb. is not adequate to permit the steam operated mechanical soot blower to do a successful job of cleaning; accordingly, compressed air, at from 125 lb. to a minimum pressure of 75 lb. is utilized in the Diamond system. Fig. 3 shows the manner of installing the heads and controller and Fig. 4, the compressor and receiver unit.

Operation is entirely automatic. Upon pressing a push button, the switch is thrown, starting the motor operated controller. The latter cuts in each head, one at a time, in the proper sequence and operates it the required number of revolutions. When all heads have

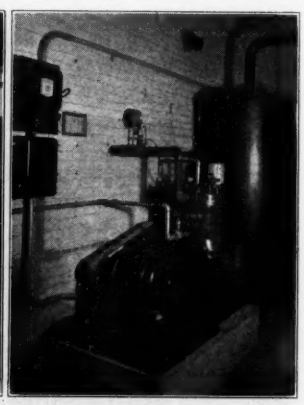


FIG. 3. (LEFT) DIAMOND AIR OPERATED SOOT BLOWER HEADS. FIG. 4. (RIGHT) THE COMPRESSOR AND RECEIVER UNIT

been operated and the cleaning cycle thereby completed, the controller shuts down the system.

THE ENGINEER CO.
NEW YORK, N. Y.

During the past year outstanding advances in the application of cross baffles to vertical bent tube boilers have been made by The Engineer Co. The development of curved baffles has made possible gas passages of stream line contour, so arranged that all of the heating surface of the boiler becomes effective.

Methods have been devised and materials developed that permit great flexibility of design; and, at the same time, maintain strength. The curved surfaces prevent eddy currents and eliminate pockets where soot or fly ash can gather, making possible the more effective operation of the soot blowers. The draft loss through the boiler is invariably reduced from 40 to 60 per cent and, in addition, material reduction in flue gas temperature have been realized. In one case a 1000-hp. boiler at 460 per cent rating showed a draft drop of 1-3 in. In general, the application of cross baffles will increase considerably the output of the boiler and at the same time secure higher efficiency of operation. Figure 5 shows a typical installation. The application of Enco Cross Baffles in five boilers in this plant made it possible to meet a large increase in load without installing additional units.

FOSTER WHEELER CORP., NEW YORK, N. Y.

Modernization of eleven boilers at the Kearny Station of the Public Service Electric and Gas Co. is rapidly nearing completion. The furnaces of eleven 2360-hp. cross drum boilers are being improved by the installation of Foster Wheeler waterwalls.

Side waterwalls consist of inclined water tubes, the lower tubes being protected by cast iron armor known as the type "B" block. The upper tubes are left bare. The rear walls are composed of vertical tubes, the lower sections of which are converted by cast iron blocks to provide a continuous erosion resisting surface in the clinker zone. The type B block is shown in detail by Figure 6.

Blocks are fastened in pairs to the tubes by means of a pin and eye bolt, forming a toggle assembly. The

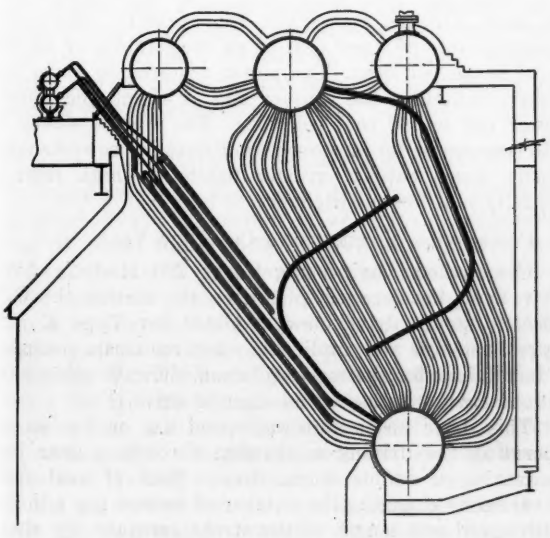


FIG. 5. CROSS BAFFLES OF THE ENGINEER CO.

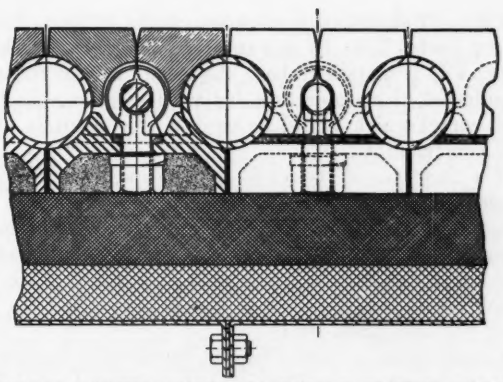


FIG. 6. FOSTER WHEELER TYPE B WATER WALL

use of two blocks assembled as a single unit, permits a larger area of contact between block and tube than could be obtained were single blocks used. Actually more than two-thirds of the tube periphery is in contact with the blocks. The blocks are constructed so that they pivot and move around the periphery of the tube to maintain contact with the tube, notwithstanding change in alignment and spacing of the tubes or expansion of the block itself.

Waterwalls in these furnaces will effect several major economies. Increasing the radiant heat absorbing surfaces of the steam generating unit will increase the capacity of the units due to both the larger steam generating area and the ability to operate stokers at a higher rating. The efficiency will be increased by the ability to operate with a lower percentage of excess air without obtaining destructive furnace temperatures. Refractory troubles are eliminated by removing refractory from the fire zone immediately above the stoker. Furnace temperatures are reduced by increased radiant heat absorption with corresponding reduction in clinker troubles on the grates. The location of a relatively cold metal surface along the grate provides a wall to which clinker cannot adhere.

The steam generator units, as remodeled, operate at a pressure of 385 lb. per sq. in. at a rating of 350 per cent burning 30,000 lb. of coal per hour.

PLIBRICO JOINTLESS FIREBRICK CO., CHICAGO, ILL.

This company is announcing the development of the Plibrico Interlocking Corbel Tile for use in connection with furnace linings constructed of Plibrico Jointless Firebrick. The several types of furnace construction made possible by this tile are covered by patents issued July 28, 1931.

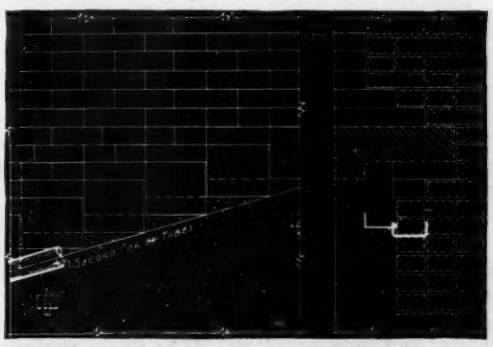


FIG. 7. INSTALLATION AND CONSTRUCTION OF THE PLIBRICO INTERLOCKING CORBEL TILE

Figure 7 shows an application of the Plibrico Interlocking Corbel Tile. In this application, the Interlocking Corbel Tile is installed above the second row of tubes in the sidewall of a water tube boiler. It replaces the firebrick corbel which would be used at this point in ordinary construction.

The function of these tile is to support the firebrick alongside the tubes. When replacing the lining in the firebox, they eliminate any possibility that the firebrick lining above the tube line will fall down. In connection with our Flexo-Anchor, they make it impossible for the monolithic lining to bulge or break away from the exterior common brick wall.

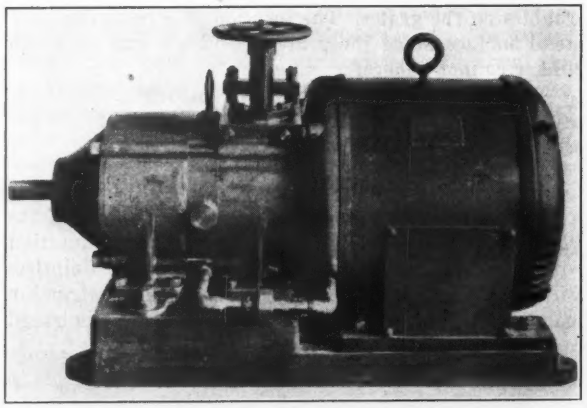
Construction of the Plibrico Sectionally-Supported Wall incorporates the Plibrico Interlocking Corbel Tile so that a monolithic Plibrico wall may be divided into several independent sections with each section supported by a row of Interlocking Corbel Tile. These tile transfer the weight of the various sections to the common brick exterior wall. It will be noted how easily any section of the wall can be repaired without disturbing other sections.

The Interlocking Corbel Tile is made of highest quality refractory. Actual brick tests made by the Mellon Institute show that these tile have a load bearing capacity of 6400 lb. each which is ample to sustain any load requirement with a large factor of safety.

Stokers and Pulverized Fuel Equipment

AMERICAN ENGINEERING CO., PHILADELPHIA, PA.

THE AMERICAN Engineering Co. of Philadelphia announces the introduction of a compact 5-hp. electro-hydraulic transmission, which will develop full rated



TRANSMISSION UNIT HAS HYDRAULIC MOTOR AND PUMP MOUNTED ON RESERVOIR BASE AND DRIVEN BY ELECTRIC MOTOR

torque at any speed, from 1 to 1000 r.p.m. Since torque is constant, the horsepower output varies with the speed of the hydraulic motor, developing 5 hp. at maximum speed.

In the illustration, the hydraulic motor is at the left, hydraulic pump in the middle and electric motor at the right. All are mounted on a single bed plate which contains the oil reservoir used in the system.

Pump and motor, of the Hele-Shaw design, are similar in construction except that the motor has a fixed stroke while the pump stroke may be varied from minimum to maximum, the electric motor driving the pump shaft at a constant speed, 1150 r.p.m. Oil is delivered by the pump to the motor at a rate corresponding to the stroke of the pump, as regulated by the hand wheel shown or by any other desired hand or automatic control. This is the only point of regulation, speed being varied from zero to maximum in either a forward or reverse direction.

MARINE STOKERS

One of the interesting installations of Taylor Stokers is that on the SS Beaverhill, a Canadian Pacific Steamships, Ltd., vessel, plying between London and Montreal The stokers are of the multiple retort type, 5 retorts wide and 20 tuyeres long as shown by Fig. 2. The rotary ash discharge consists of a single roll unique in that it is operated by a pawl and ratchet mechanism connected directly to the stoker drive shaft.

Stoker drive is a modification of the one used on land stokers. A variable speed motor in conjunction with a switch gear, gives the operator 20 different speeds in a ratio of four to one. The power box itself has two speeds.

With the marine stoker, it is possible to burn a large variety of coals at efficiencies heretofore only obtainable

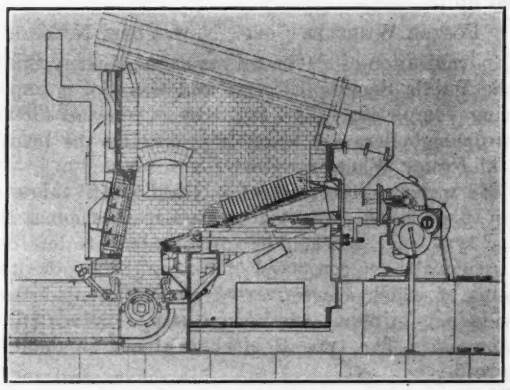


FIG. 2. SECTIONAL DRAWING SHOWING THE TAYLOR STOKERS ON THE S.S. BEAVERHILL

on land. On the Beaverhill, for example, efficiencies reported were 85.5 per cent at an evaporation of 16,000 lb. of steam per hour. The power required to drive the stoker, including the crusher roll is about one horsepower per ton of coal per hour. The marine stoker is also responsible for improved conditions in the stokehold, steady steam supply, greater flexibility, high reserve capacity and low maintenance.

COMBUSTION ENGINEERING CO., NEW YORK, N. Y.

Combustion Engineering Corp., 200 Madison Ave., New York, has recently placed on the market the C-E Electric stoker drive, now available for Type E and Type K stokers and applicable wherever steam pressure is insufficient for the standard steam drive or other conditions favor the use of an electric drive.

This drive has a constant speed a.c. or d.c. motor operating the driving mechanism through a gear box containing a double worm drive. Rate of coal feed is varied by changing the number of strokes per minute, with speed and length of the stroke constant, by altering the length of the rest period between strokes through

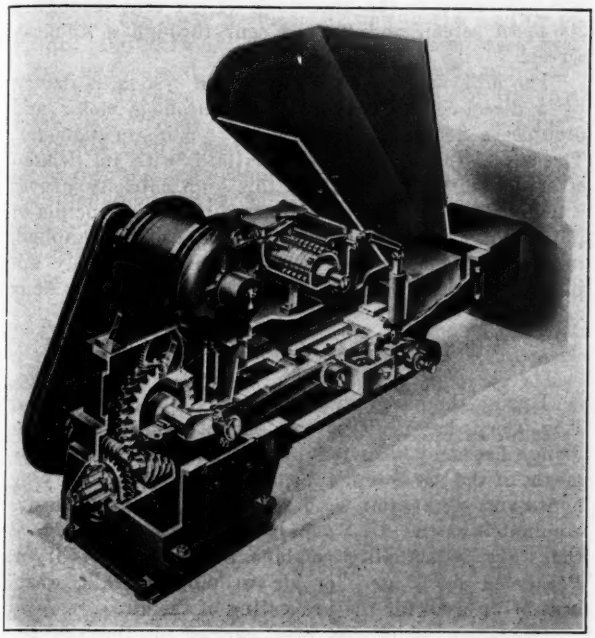


FIG. 3. C-E ELECTRIC DRIVE FOR PLUNGER STOKERS

a simple timing device. Gears and cams are entirely enclosed and run in oil.

For stokers requiring not more than 7500 c.f.m. of air, the fan is an integral part of the drive unit. For stokers requiring larger quantities of air, a separate fan unit is provided.

Stoker Unit

Another recent development in the stoker field is the C-E Stoker Unit for application under boilers of 50 to 200 rated boiler horsepower. The design of this stoker is based on the experience gained in many years of stoker work. The outstanding features are a self-contained drive and fan, all completely enclosed, laterally agitated grate bars and side dump grates with forced draft control, agitated feed hopper which prevents arching of the fuel, a selective silent gear, constant speed drive with a wide range of adjustment. Unusually heavy construction is used throughout. It is easily installed, burns a wide range of fuel and will operate for long periods without attention.

Raymond Roller Mill

There have been also several developments of interest in connection with certain other types of equipment. The Raymond Roller Mill, formerly used entirely with the storage system of pulverized fuel, has been successfully used with direct fired systems. One such installation operating satisfactorily under extremely variable load on all units is at the Pittsburgh Steel Company, Monessen, Pa. The use of the central system of oil lubrication for the roller journals eliminates the necessity of stopping the mill for lubrication. The oil lubricated roller journal is a major improvement and has greatly decreased the cost of maintenance. The use of hot air or flue gas to dry the coal as it is being ground in the mill has been widely extended and makes the system simpler on account of the elimination of separate dryers and dryer exhausters.

Detroit Stoker Co., Detroit, Mich.

One of the many improvements which have been made in Detroit Single Retort and Detroit UniStokers is a new style plate tuyere arrangement shown by Fig. 4 to fit Detroit Single Retort or Detroit UniStokers. This will give longer life for parts and better operation. In arrangement A for the smaller sizes of these machines the plate tuyeres replace the block type tuyeres and the new style dumping grates are added. For stokers six feet and wider, arrangement B using the new style plate type tuyere and dead plate with the new style heavy dumping grate section is recommended.

These new parts are particularly advantageous for moderate rates of combustion and coals that are low in ash and have a low fusing point in ash. In addition to much longer life of parts, the new arrangement facilitates proper distribution of fuel, fires are more easily cleaned and higher rates of combustion with good economy are secured. The parts are made of a special mixture of high heat resisting iron from metal patterns insuring long life and uniformity of size.

Fuller Lehigh Co., New York, N. Y.

Emphasis placed on the economical use of pulverized-coal by small and medium sized industrial boiler plants has resulted in the need of a coal pulverizer that has the same relative performance and reliability demanded of higher capacity pulverizers in the larger stations. To meet these requirements the Fuller Lehigh Co., New York City, has developed and placed on the market a new pulverizer known as the Type C pulverizer.

The design of this mill includes the ball and grinding ring principle of pulverizing. In this arrangement coal is pulverized by large-diameter balls grinding under pressure between upper and lower grinding rings. Pressure between the grinding parts is applied and maintained by a heavy steel spring mounted in the top section of the mill.

Wet coal can be pulverized in the Type C pulverizer when preheated air is used for separation of the fines. A change in capacity is made by simply varying the rate of the coal-feed to the mill.

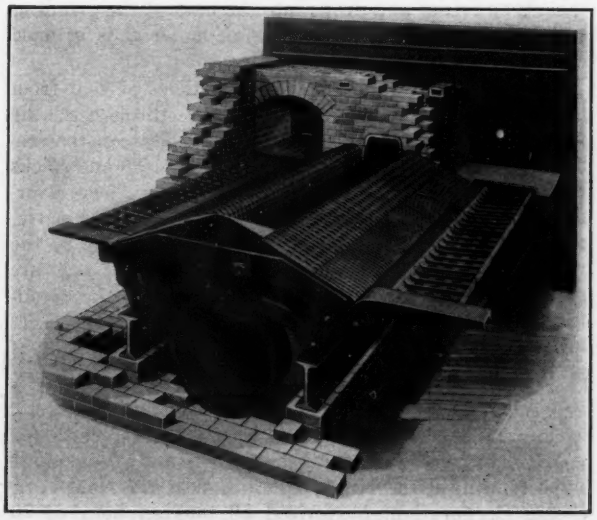
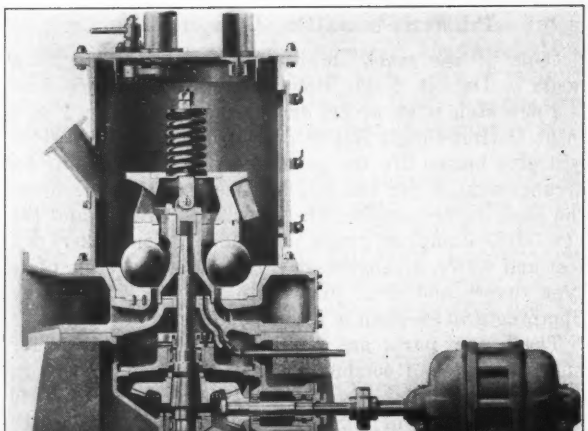


FIG. 4. NEW STYLE TUYERE, DEAD PLATE AND DUMP CONSTRUCTION FOR THE DETROIT SINGLE RETORT AND UNISTOKER



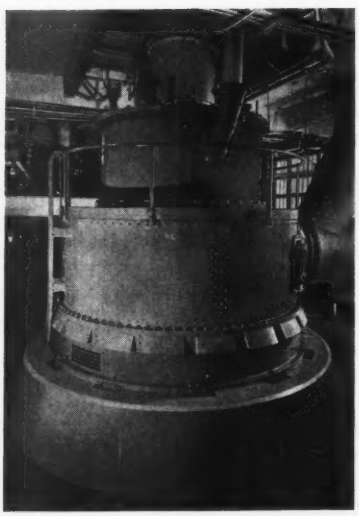


FIG. 5. (ABOVE) FULLER LEHIGH TYPE C MILL

FIG. 6. (RIGHT) TYPE B MILL AT KIPS BAY STATION

Raw coal, crushed to pass through a ¾-in. ring, is fed to the mill from an overhead bunker by means of a table-type feeder and drops into the path of the grinding balls. Tramp iron or other foreign material is at once rejected outward from the grinding zone.

Air, for separating the coarse particles of coal from the fines, enters the mill under pressure through the air inlet in the intermediate section, flows between the stationary grinding-ring and the driving-yoke and picks up the particles of finely pulverized coal. The pulverized-coal and air streams continue their upward movement whence they are discharged through ports in the rotating spider. Here, the coarse particles of coal are separated from the fines and drop back into the grinding zone for further pulverizing. Type C pulverizers are available in capacities ranging from 1 to 6 t. of coal per hour.

High Capacity Pulverizer

At the opposite extreme a remarkable record for coal pulverizers was established when a Fuller Lehigh Type B Mill, at the Kips Bay Station of the New York Steam Corporation, pulverized 50 tons an hour of 70 grindability coal from the Pittsburgh Seam. The coal was pulverized to the fineness of 71 per cent through a 200-mesh screen and 98 per cent through a 40-mesh screen.

The mill, which is used with a bin system, is driven by a direct-connected vertical synchronous motor and occupies a floor space of only 14 ft 6 in. in diameter. The successful operation of this mill, with its demonstrated ability to operate at this high capacity proves conclusively that the ball-and-grinding-ring principle of pulverization, with grinding pressure positively applied, independently of the speed of the mill, is equally applicable whether the mill is of 500 lb. or 50 t. per hour capacity.

Kennedy Van Saun Mfg. & Eng. Corp. New York, N. Y.

During the past year the Kennedy Van Saun Mfg. & Eng. Corp. has made several substitutions of the unit firing of cement kilns for installed storage systems. By means of the Air-Swept tube mill, the dryers and drying house and storage bin used with the storage system are eliminated as the Air-Swept tube mills are so designed that they in actuality combine pulverizer and dryer. Preheated air is used for air-sweeping the mill, waste heat being used for the preheating of the air.

Operation which has been carried on through the winter months when coal is frequently delivered with a very high moisture content due to snow storms encountered between the mines and the plant, has demonstrated conclusively the fact that the combined dryer and pulverizer feature of the Kennedy Air-Swept Tube Mill will successfully handle very high moisture content in the fuel without the assistance of an external drier. This application of the slow speed air swept tube mill to unit firing of cement kilns is an extension of the same system which has been so satisfactorily applied to steam generation.

Clinker Pit Air Heater

As an adjunct to the unit firing of cement kilns the company has developed an air heater for preheating the air used in air sweeping the tube mill. This air heater utilizes the waste heat in the clinker pit and is designed to withstand the abrasive action of the clinkers, being built into the clinker pit itself, and absorbing heat by direct contact with the hot clinkers as well as from the hot gases of the clinker pit.

Combined Steam and Electric Pulverizer Drive

In order to obtain automatic combustion control, it is more convenient and positive to use electric drive units where variable speed is required. In the case of the Kennedy Pulverized Fuel System, this means electric drive for the primary air fan and for the feeder. The mill drive, which is at constant speed, can employ steam or electric drive with equal facility.

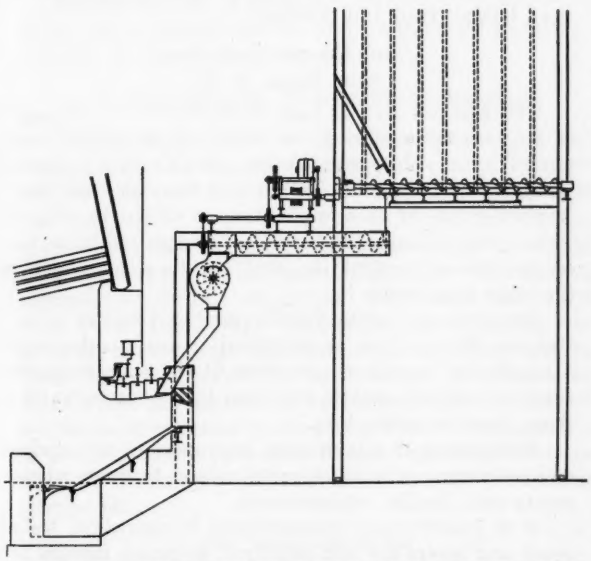
In a great number of the smaller plants and especially in marine installations, there is not available sufficient electric power to permit the use of electrically driven auxiliary units. To meet this condition, the Kennedy Combined Electric and Steam Drive has been developed. This drive consists of a high speed, low water rate turbine which drives the pulverizer at a constant speed through a two-stage gear reduction. At the first reduction is connected an electric generator having sufficient power to furnish the electric current for the primary fan and feeder drive and, if so desired, extra current for plant use.

THE M. A. HOFFT CO., INDIANAPOLIS, IND.

Among the early problems arising in the feeding of sawdust and shavings into boiler furnaces, were first a fire risk caused by possible back firing and puffing of the furnace and second, the arching of the fuel in the bin. To overcome the first difficulty, a rotary feeder has been placed on the market for use between the end of the screw and the furnace as shown in the accompanying illustration. This is designed to provide an effective air seal and to prevent back draft, sparks and backfire from getting to the bin. In addition, it serves to shut out the air entering the furnace with the feed, as this air was found undesirable.

To solve the second problem, the arching of the fuel in the bin, the bin has been designed with a flat steel bottom and either vertical or slightly tapering sides. The bottom of this bin is practically covered with a series of heavy helicoid screws as shown in the illustration. This equipment has been developed by The M. A. Hofft Co. of Indianapolis, Ind.

As shown, the screws covering the bottom of the bin are connected in series of three. Any series or all the screws may be operated as desired. These screws are designed to slip the fuel forward into a trough extending at right angles to the screws. This slipping forward, together with a slight agitation caused by the turning of the screws, overcomes the tendency of the fuel to arch, it is stated, even with coarse hog fuel and ground veneer strips containing long slivers.



AUTOMATIC WOOD REFUSE FEEDER WITH SCREW BOTTOM BIN SHOWING ALSO THE USE OF ROTARY FEEDER BETWEEN END OF FEED SCREW AND FURNACE

The feeding equipment, even for large boilers, is driven by a 3-hp. constant speed motor, driving a variable-speed transmission through the proper reduction gearing. The arm controlling the variable speed transmission is connected to an automatic pressure control, which moves this arm back and forth to control the speed of the unloading screws on the bottom of the bin. It is stated that in this way the speed can be controlled so as to hold the steam pressure to within 3 or 4 lb. even with a widely fluctuating load, screw speed being controlled by the steam pressure.

Coal and Ash Equipment

AMERICAN ENGINEERING CO.
PHILADELPHIA, PA.

IN ORDER TO OVERCOME objections to old ash hoppers, principally waste and dilution of high pressure water, high maintenance, damming of the sluice and lack of positive ash feed, a new ash hopper for use over an ash sluice was developed by the American Engineering Co. The hopper consists of two sections, the upper or storage section and the lower or auxiliary roll section. Figure 1 shows them bolted together. The sectional construction permits shipment in large units and speeding up erection. The auxiliary feeder rolls in the lower section are not to be confused with the stoker crusher rolls. Although they are sufficiently powerful to crush clinker and can do so in an emergency, their principal function is to feed the ash to the sluice at a constant rate. Positive, controlled discharge is the feature of this hopper.

Stoker crusher rolls are driven by a Hele-Shaw hydraulic pump and a ram connected to a ratchet and pawl mechanism. The auxiliary rolls are driven in the same way. In fact, since so little power is required, it can be taken from the crusher pump. Power might otherwise be taken directly from the stoker drive shaft through a suitable linkage or from a separate electric motor. Hydraulic drive makes possible synchronization of the feeder and crusher rolls, an important advantage when it is desired to make disposal automatic. Through pressure control, the rams can be regulated so that those on the stoker and that on the feeder must all complete one stroke before starting the next, regardless of how fast each individual ram completes its own stroke. Synchronized, the feeder rolls start discharging as soon as the crusher rolls move. Water is turned on before discharge begins.

The hopper is fabricated of cast-iron sections which have overlapping, interlocking edges on all four sides, drawn tight by bolting to a steel framework. There are sufficient observation and access doors to make each part of the hopper and rolls accessible. Ashes can be dropped through the main access door on the sloping side into a car in an emergency, eliminating the need of a spare sluice pump. A unique feature of the hopper is the

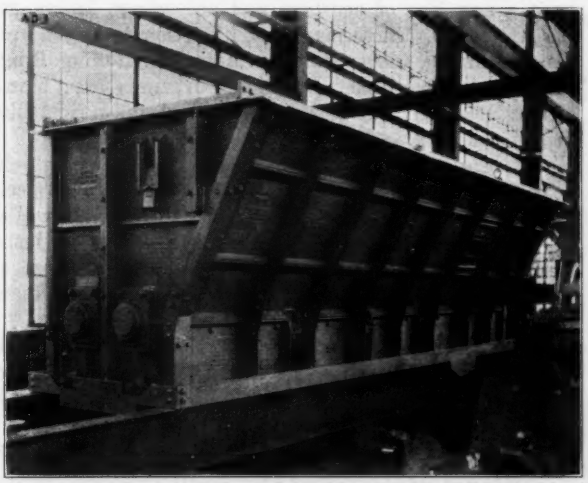


FIG. 1. AMERICAN ENGINEERING CO. ASH HOPPER

gas seal at the bottom of the hopper, below the feeder rolls. When the boiler is off the line, toxic gases from other steaming boilers might find their way back through the main sluice to the ash pit of the boiler which is out, resulting in injury to anyone working on repairs. This possibility is prevented by the gas seal, a pair of gates which slide together, closing off the opening. The drive for the gates is hand operated and positive in either direction.

One of the hoppers which is now in service has a storage capacity of 14 hr. at 300 per cent of rating. This is very unusual under the conditions which prevail for the distance from the crusher to the basement floor is only 5 ft., 8 in. A similar hopper may be used elsewhere to save six to eight feet in the height of a building.

There are 13 advantages for the new hopper, which, briefly summarized, are:

1. Positive controlled discharge of ash. There is no danger of plugging sluice for no oversize particles can get into it.
2. Ash is in proper condition to be sluiced.
3. Very little power required, less than 5 hp. to feed ash to sluice.
4. Saving in high pressure water, resulting not only in economy of operation but in first cost as only small pump is needed.
5. Synchronization of crusher and feeder rolls.
6. Power can be taken from existing drives.
7. Can be used with underfeed, overfeed and chain grate stokers or easily adapted for powdered coal, where large clinkers frequently plug up sluice line.
8. Gas seal.
9. Watertight. Plates lap on all four sides and are drawn tightly together.
10. Prepares ash for pumping to fill.
11. Saving in building height.
12. Can be used with dump type stoker or powdered coal furnace because ash can be crushed ready for sluicing. No extra crusher is required as the ash is sized while being discharged.
13. Very little attention required, which makes remote control possible.

American Pulverizer Co.
St. Louis, Mo.

American Pulverizer Co. has recently designed and built a new line of crushers and pulverizers known as the AC Series. These machines, like other types we are manufacturing, incorporate the American Rolling Ring principle of crushing. Additional features are: Manganese Steel grinding parts; metal trap, and adjustable drop bottom cage.

The cage consists of a heavy cast steel frame, which holds the manganese steel grate bars, or perforated steel screen plates. The cage adjustment can be made while the machine is in operation; the purpose of the adjustment is to compensate for wear, as well as to secure a finer or coarser product. Another important advantage of the cage is to relieve the machine from clogging.

A metal trap or tramp iron catcher is incorporated in the design. Exterior of a No. AC-3 American Ring crusher as shown by Fig. 2 indicates the rigid and compact construction.

Housing or casing of the machine consists of a number of heavy steel castings reënforced with ribs wherever crushing strain is greatest. The machine is

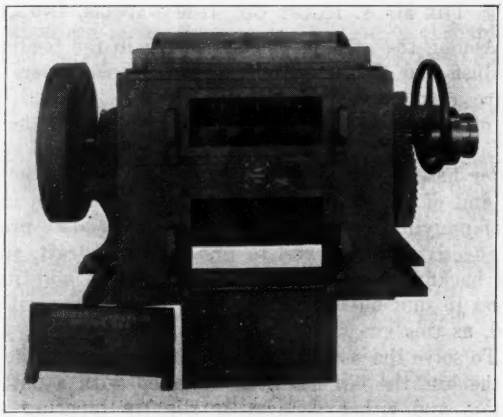


FIG. 2. ONE OF THE AC-SERIES CRUSHERS OF THE AMERICAN PULVERIZER CO.

equipped with Timken Roller Bearings; a double row of Timken Bearings are mounted in cast steel dust and oil-tight pillow blocks. The main shaft is of select alloy steel, lathe-turned and polished.

John Chatillon & Sons
New York, N. Y.

The Electric Eye or light sensitive cell is employed as a means for totalizing the weight of materials transported by the Telepoise Feeder and Conveyor Scales, manufactured by John Chatillon & Sons of New York. A photograph of this application is shown by Fig. 3. This is one of a number furnished a large public service corporation to control the coal fed to stokers and at the same time weigh it.

Photo-electric units (Radiovisor) a product of the Burgess Battery Co., is employed in conjunction with a simple but ingenious invention of the scale manufacturer to convert electric impulses into pounds, barrels, short, long or metric tons.

Advantages of this modern improvement are obvious and numerous; eliminates parts subject to wear, adjustments and, finally, replacements.

It is positive and instantaneous in operation, weigh beam and levers are not employed as prime movers for any device; they are free to indicate accurately the weight on the scale, which is electrically transmitted to a register, indicator or recorder or a combination of any

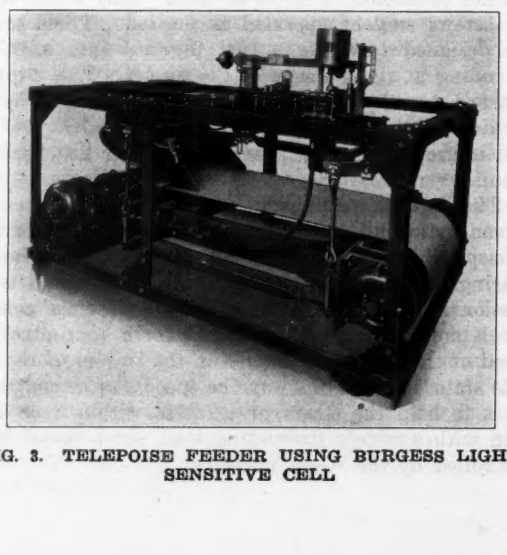


FIG. 3. TELEPOISE FEEDER USING BURGESS LIGHT SENSITIVE CELL

two or all three of these instruments. Positive automatic control can be furnished with the Telepoise scales which will prevent a down-spout, hopper or bin from overflowing or being emptied.

KENNEDY VAN SAUN MFG. & ENG. CORP.
NEW YORK, N. Y.

Demand for a simple effective pneumatic transport system for pulverized materials, which shall be free of mechanical parts, has led to the development of the Kennedy Transport System wherein transportation of the material is effected by pneumatic means alone. In lieu of the breech block produced by a mechanically driven feeder or pump which prevents back blowing into the storage bin, a safety check operated by the building up of the pressure in the transport line is used. Advantages of this transport system lies in the elimination of all power requirements other than that of the conveying air itself and a very low maintenance cost, as all mechanically driven units working in the pulverized material are eliminated.

Transportation is produced partially by extrusion of an air saturated mixture and partially by pneumatic impulse in the transportation line.

CONTAINERS FOR PULVERIZED MATERIALS

The increasing amount of bulk shipments of pulverized materials has created the need of standard containers which can be fitted to standard railroad cars or motor trucks.

To meet this demand, the company has developed such a container which may be used for cement, pulverized fuel, or like shipments. Containers are welded steel tanks fitted with connections for applying the Kennedy Pneumatic Transport System. They may be filled either by gravity or by transport system at the point where the material is pulverized, then transported by rail, boat or motor to the point where the material is to be used, where they may be used as storage bins or may be discharged pneumatically into a permanent storage bin.

FLY ASH COLLECTOR

Although the question of fly ash for pulverized coal plants has been greatly exaggerated, due to a number of installations wherein has been neglected provision for the fundamental combustion requirement, yet it is a recognized fact that wherever fuel is burned there is bound to be a certain amount of ash, part of which will go up the stack. With the justly increasing demand from the civic authorities throughout the country for the elimination of all air pollution, attention is being given more and more towards means for the elimination of all fly ash as well as smoke.

For the small power plant, it is imperative that these means be simple and obtainable at a reasonable price. To this end, the Kennedy Fly Ash Collector has been developed, which embodies the principle of the vacuum cleaner and cyclone precipitator. The collector is attached at the last pass of the boiler or close to the base of the stack. It consists of a collecting chamber fitted with a longitudinal nozzle that in turn is connected to the path of the flue gas at a point where the gases are making a right angle bend. The longitudinal nozzle continues into the collector chamber and forms a baffle, with the narrow nozzle opening on one side and the large collecting chamber on the other.

To the collecting chamber is attached the suction of a fan which in turn discharges into the gas pass further along its travel. The fan reduces the pressure in the larger chamber and thereby produces a vacuum cleaner effect, as the nozzle augments the tendency of the solid particles in the gas stream to precipitate which tendency has already been stimulated by the fact that at the point of attachment the gases are making a bend in their travel. The high velocity of the gas stream through the nozzle is suddenly reduced by the discharge of the stream into the large chamber and precipitation is effected by this action which is, in reality, the action of a cyclone collector.

LINK-BELT CO.
CHICAGO, ILL.

Link-Belt Co., Chicago, announces the addition to its line of the K-48 all-purpose unit to serve as a shovel, crane, trench hoe or dragline outfit, with all attachments that are available on smaller machines. It is built for drive by gasoline or Diesel engine or by electric motor, the gasoline engine drive being for 130 hp. heavy duty rating and other methods of corresponding capacity.

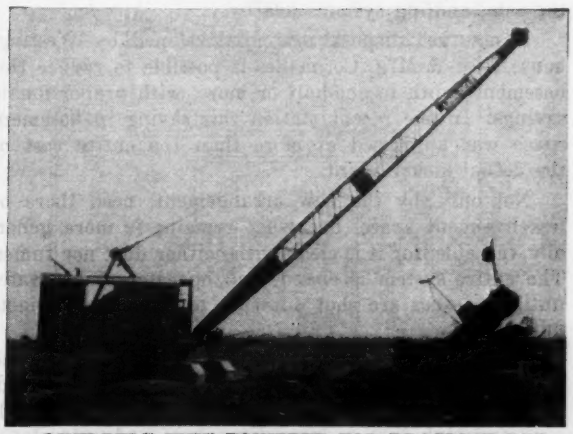
Used as a shovel it has a 25-ft. boom, 17 ft. 6 in. dipper stick and 1¾ cu. yd. dipper. As a crane, it has a 33⅓ per cent or more margin against tipping with rating of 32 t. at 12-ft. radius and 5 1/5 t. at 45-ft. radius on a 45-ft. boom, or a 1½-cu. yd. heavy bucket or 1¾-cu. yd. light-medium bucket on a 50-ft. boom, working at any angle convenient for dragline work.

For normal depth digging in average soils, a 2-cu. yd. solid bottom bucket is used for trench hoe work, the bucket size varying according to depth and character of work.

Equipped with large crawler rollers, self-cleaning treads, large drums, clutches and brakes, the unit is designed for ready conversion from one purpose to others, thus permitting use to fullest advantage.

RICHARDSON SCALE CO.
CLIFTON, N. J.

Convey-o-Weigh, the latest development of the Richardson Scale Co., Clifton, N. J., is a system



LINK-BELT UNIT EQUIPPED FOR DRAGLINE USE

of conveyors and scale levers. The weighing conveyor, which is suspended from scale levers, runs continually but the feed conveyor stops when the weigh conveyor has received its predetermined load. As soon as the larger portion of the weighed load has run off the weighing conveyor, the feeder again starts and delivers another weighing. Each lot of material is actually weighed and each weighing is separate and distinct from the others. An interval between weighings can be so regulated that the weighed material is delivered in a practically continuous stream.

Stephens-Adamson Mfg. Co.
Aurora, Ill.

Recently developed by Stephens-Adamson Mfg. Co. of Aurora, Ill., the apron gate, for horizontal bin bottoms, operates on an entirely new principle without sliding friction.

As shown in the illustration, the new gate is closed by a series of reinforced cross bars, covered with a rubber apron, which prevents spillage and the leakage of drain water between the bars. A rack and pinion, driven by push rod or chain wheel, moves an operating carriage back and forward to open and close the gate. In opening, the carriage is pulled backward, causing the two lower rollers to lift the apron bars slightly and disengage the hooks. The cams shown hold the hooks out until the rollers have passed and the apron has dropped. In closing, the carriage is pushed forward, the cams open the hooks, the rollers lift the bars into place, the hooks engage and the apron bars support the load in the bin above.

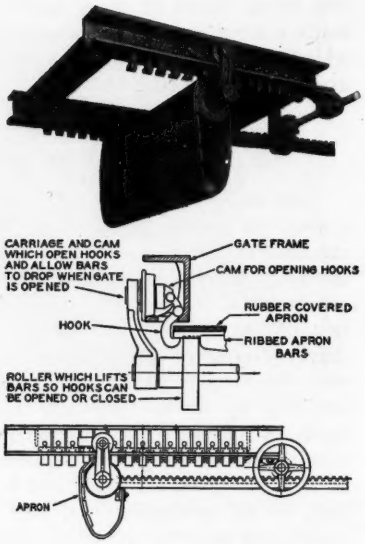

CARRIAGE AND CAM WHICH OPEN HOOKS AND ALLOW BARS TO DROP WHEN GATE IS OPENED
GATE FRAME
CAM FOR OPENING HOOKS
RUBBER COVERED APRON
HOOK
RIBBED APRON BARS
ROLLER WHICH LIFTS BARS SO HOOKS CAN BE OPENED OR CLOSED
APRON

FIG. 6. STEPHENS-ADAMSON APRON GATE

Portable Car Pullers

S-A Engineers have also devised a special portable mounting for their standard line of car pullers. This mounting consists of a standard gage, four-wheel, structural steel truck on which the car puller is mounted as shown by Fig. 7. It can be moved to any spot on the switch siding and quickly clamped to the rails, ready to pull several loaded cars from any direction.

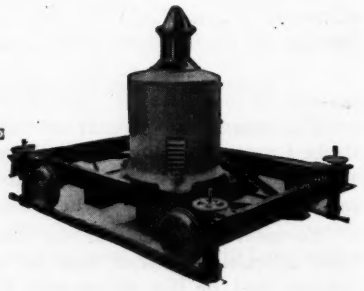


FIG. 7. S-A PORTABLE CAR PULLER

Westinghouse Elec. & Mfg. Co.
E. Pittsburgh, Pa.

Under modern power plants with their tile walls and spotless machinery, are deep basements, whose height is often 25 ft., sometimes 40 ft. Costly space, estimated at figures up to $2 a cu. ft. Costly, but not very valuable, largely because of dirt and gases from the ash handling systems nearby.

A new ash disposal system developed by Westinghouse Elec. & Mfg. Co. makes it possible to reduce this basement depth to one-half or more, with proportionate savings. In one recent station this saving in basement space was appraised at more than the entire cost of the actual stoker plant.

Not only, by the new arrangement, need there be less basement space, but what remains is more generally valuable, for it is clean with neither dust nor fumes. The entire system is closed, and operates under water until the ashes are shot out of a pipe on some remote dump.

Ash, cinder and clinkers pass from the lower end of the furnace into the jaws of a pair of clinker grinding rolls, submerged in water, are crushed to suitable size, and sink into a dump, or ash pit, of concrete or cast iron. From its bottom, they are swept at intervals by a high-velocity water jet in an ejector nozzle, and ashes, water, and all are discharged through a pipe line to a considerable distance, or even to a higher elevation. So discharged, they are more valuable for many purposes, especially for filling ground. The entire operation can be made automatic with no manual labor whatever.

Four to five tons of ashes a minute can be removed by a small amount of water, at about 100—125 lb. pressure, which can often be taken from the plant's regulation fire pump, requiring no especial water supply.

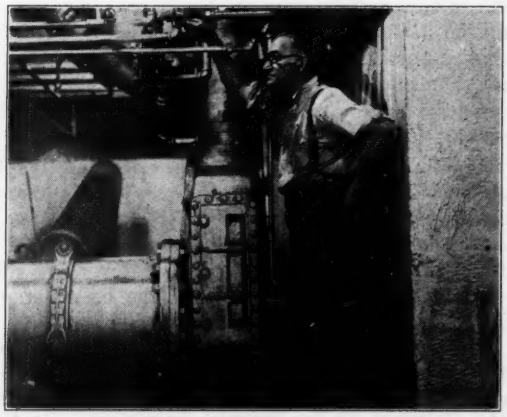
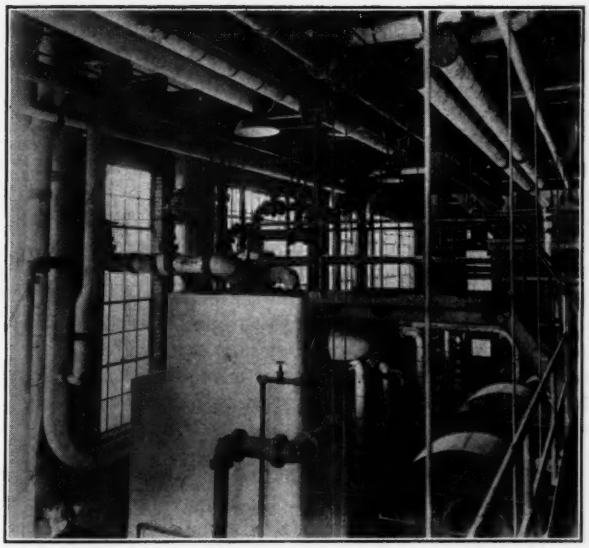


FIG. 8. WESTINGHOUSE HYDRAULIC ASH EVACUATOR

Auxiliaries and Accessories *that Improve* Boiler Room Economy



Boiler Accessories

J. A. Campbell & Co.
Long Beach, Calif.

FOR FEEDWATER REGULATION a new regulator has been developed by G. W. Volz, and is manufactured and distributed by J. A. Campbell Co. This regulator has only one moving part and is automatic in action. It consists essentially of two expansion tubes connected into a body casting and meeting at their outer extremities in a close return-bend. The lower tube is the working element and the upper tube the compensating element. The return bend carries a lug, to which the valve linkage is attached; and the expansion and contraction of the working tube induced by slight changes in water-level is multiplied and translated into vertical movement, which is directly transmitted to the valve stem.

This device will operate any standard balanced valve, such as illustrated in the drawing, Fig. 1, and can be fitted to any type of boiler where automatic regulation of the water-level is desired.

Cochrane Corp.
Philadelphia, Pa.

Among the developments that have been introduced during the past year by the Cochrane Corp. is an arrangement for continuous blowdown in conjunction with steam purifiers. The combination of a steam purifier, installed in the connection between the steam drum and the superheater, and a continuous blowdown system insures clean, dry steam with minimum heat loss. The Cochrane Purifier, which is of the external type, has been found to operate successfully where the blowdown from the boiler takes place entirely through the steam line in the form of priming.

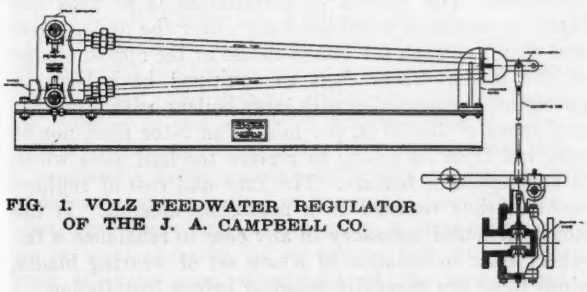


FIG. 1. VOLZ FEEDWATER REGULATOR OF THE J. A. CAMPBELL CO.

If the regular blowoff valves are not used, the concentration builds up to a point where further increase results in wet steam. The steam, however, is stripped of this moisture and accompanying solids in passing through the purifier and the heat of the separated water and sludge is removed in a suitable heat exchanger apparatus, as by flashing the trap discharges to the feedwater heater, or the flashed steam can be used to supplement the exhaust steam for process or other purposes. The heat remaining in the trap discharge after flashing can be recovered in heat exchangers of the tubular or surface type.

It has been found that where the average moisture content of the steam leaving the boiler drum is in excess of the largest amount which can be measured by a throttling calorimeter, namely about 5 per cent, the steam leaving the purifier will show less moisture than can be measured by means of a throttling calorimeter. This method of controlling the blowdown through steam purifiers is entirely automatic and operates at maximum

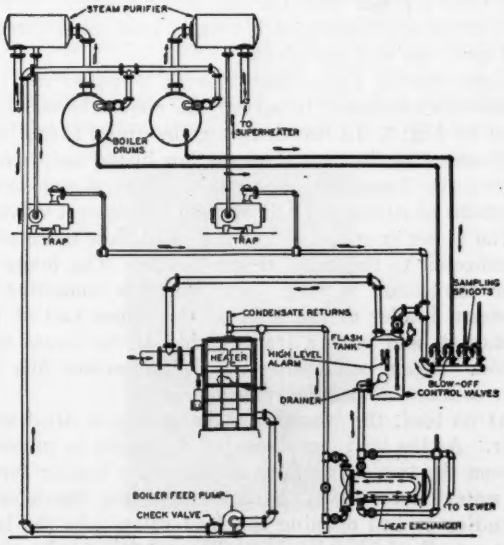


FIG. 2. COCHRANE COMBINATION BLOWDOWN AND PURIFIER SYSTEM

efficiency at all times, since the amount of blowdown is the quantity of concentrated boiler water that must be discharged in order to hold the concentration at the maximum point at which the boiler can be successfully operated.

Where either intermittent or continuous blowdown is relied upon without the use of steam purifiers, somewhat more water would generally be blown off in order to provide a margin of safety to insure the delivery of reasonably dry steam. In order to relieve the traps which drain the purifier of excessive duty, the continuous blowoff through the purifier is sometimes combined with continuous discharge through blowoff control valves, as shown in the drawing, Fig. 2, the valves being set for slightly less blowoff than is required to control the concentration, the excess or marginal amount being taken care of through the purifier.

NORTHERN EQUIPMENT CO., ERIE, PA.

A new type of feedwater regulator feeding in accordance with the rate of steam flow, with compensation

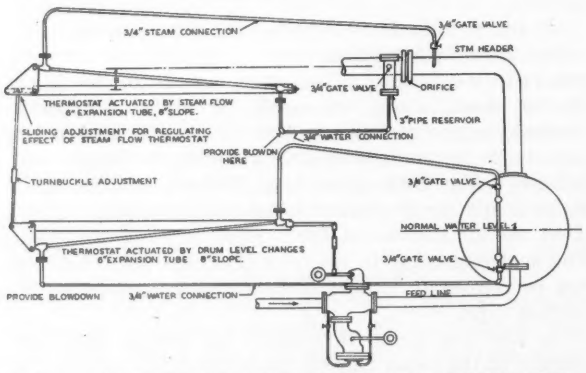


FIG. 3. COPES SERIES TYPE FEEDWATER REGULATOR

for changes in boiler water level, has been announced by Northern Equipment Co. This new regulator, known as the Copes Series Type Regulator, is designed primarily for boilers operating with rapidly fluctuating loads. Boilers carrying swing loads in a central station plant offer a major field for this new regulator. It also has a direct application on boilers in steel mills, cement mills and coke and gas plants.

Copes Series Type Regulator is actuated by two thermostats connected in series, one above the other as shown by Fig. 3. In this drawing, the upper thermostat is influenced by the rate of steam flow in the main steam header; the lower by changes in boiler water level. Movement of either one will operate the control valve.

The upper or steam end of the steam flow thermostat is connected to the main steam header. The lower or water connection is made to a reservoir connected to the steam header at the level of the upper end of the thermostat, and on the trailing side of the steam connection. Steam condensing in the thermostat fills the water connection and the reservoir.

At no load, the steam flow thermostat is filled with water. As the load increases, the difference in pressure between the two connections in the steam header forces the water level down. Steam enters the thermostat, expanding it and opening the feed valve. As the load decreases, the water level in the expansion tube rises, causing the tube to contract and close the feed valve.

If the water level in the boiler drum does not change, the entire valve movement is under the sole influence of the steam flow thermostat. It is only when boiler water level changes that there is any influence from the level thermostat.

A triangular lever is mounted at the end of each thermostat so that it pivots on a fixed point. The levers are connected by a strut, to transmit the force of expansion and contraction of the steam flow thermostat through the level thermostat and thence through a vertical strut to the feed valve in the feed line.

An adjustment is provided to permit increasing or decreasing the influence of the steam flow thermostat. There is also an adjustment in the compensation of the level thermostat.

Through the design of the control valve fittings, it is possible to control the ratio of inflow to outflow. This ratio may be such that a high water level is carried at high loads and a low level at low loads, or at any stage between this and the exact reverse of low level at high loads and high level on low loads.

PRAT-DANIEL CORP., NEW YORK, N. Y.

Perhaps the most serious fan problem which has occurred since pulverized fuel became common practice

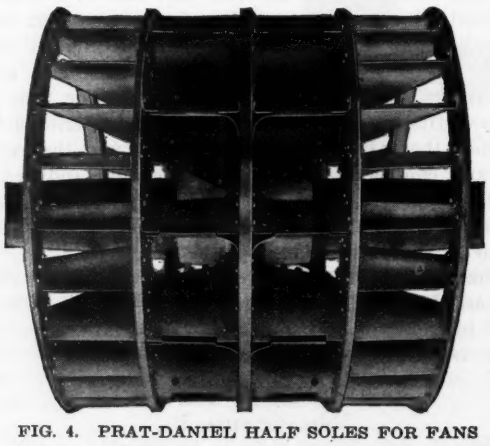


FIG. 4. PRAT-DANIEL HALF SOLES FOR FANS

is the erosion of fan blades handling the flue gas. The Prat-Daniel Corp. has had in use for about a year a removable wearing plate which is superimposed upon the fan blade itself and which has satisfactorily solved this difficult problem.

These half soles are especially shaped so as to avoid all corners or angles where the dust can concentrate its cutting action. This is shown toward the center disc in Fig. 4. The blades are bolted on the under blade with special lock nut construction impossible to loosen during operation. The method of installation is to hook the blade, by means of a welded flange, over the under blade and then to attach the bolted flange at the opposite edge of the blade. These fans so equipped have been in operation in connection with large boilers, with a peripheral speed of 13,600 ft. per min. Fan rotor need not be removed from its casing to replace the half soles which is an important feature. The time and cost of replacement is thus reduced to a negligible amount. It has not been found necessary in any case to rebalance a fan wheel after installation of a new set of wearing blades, since these are carefully weighed before installation.

This solution was reached after extensive research in the use of manganese steel, other special steels, and stellited blades, and needless to say, the cost of replacement is a fraction of the cost of a new wheel.

SCHUTTE & KOERTING CO.,
PHILADELPHIA. PA.

In the accompanying illustration is shown a boiler water level indicator which is part of the S. & K. Televisor recently put on the market by the Schutte & Koerting Co., of Philadelphia Pa. The complete unit consists of: transmitter which is attached to boiler drum and takes the place of, or is used in conjunction with, the standard water column; the distributor installed on a near-by wall and the illuminated indicator (illustrated) which is located at convenient height on boiler room wall or elsewhere in the plant where readings are desired. The outstanding feature of the Televisor is

S. & K. TELEVISOR WATER LEVEL INDICATOR

the fact that it is operated electrically and the indicator may be located some distance from the boiler drum.

The transmitter contains a set of electrodes of various lengths and is provided with connections for gage glass, try cocks and blow-down. The electrodes are connected by multiwire cable to relays in the distributor. They make contact with boiler water as the level rises in the transmitter. The indicator contains a double row of small lamps illuminating a vertical prism. These lamps receive low voltage current through the relays in distributor. Electrodes in contact with the water light green lamps in the indicator while those above water level light red lamps, the two sets showing in the prism as a column of light, the lower section green, the upper section red. The dividing line between the colors is the boiler water level with reference to predetermined low and high limits.

YARNALL-WARING CO.,
PHILADELPHIA, PA.

Water Gage Steel Inserts, of the two-glass and four-glass type, have recently been placed on the market by Yarnall-Waring Co., Philadelphia, Pa.

One of the most important items of construction of these inserts is the Improved Condensate Guide, a channel of circular cross section, drilled through the insert body, parallel to and connected with the glass chamber. Top and bottom gage connections discharge directly into the condensate guide, causing all of the condensate to run down the guide instead of down the glass. The condensate guiding channel feature is connected to the glass or sight chamber, by an ample, full area slot to permit instantaneous adjustment of the water level

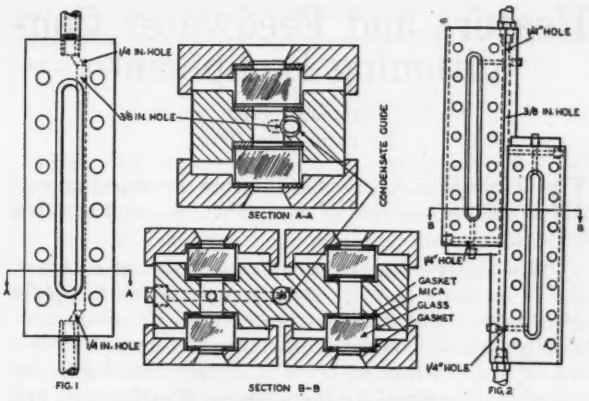


FIG. 1. TWO-GLASS FLAT TYPE
FIG. 2. FOUR-GLASS FLAT TYPE

without permitting the condensate to flow out until it reaches the water level.

Since the Improved Condensate Guide eliminates discharge against the glass, it is claimed that much thinner mica can be used, allowing more light to pass through the insert, increasing visibility and life of glass and mica.

These Water Gage Steel Inserts are machined from solid rolled steel bars. Gage valves are of forged steel, monel trimmed with renewable seats. The studs are all of class "C" bolting material. In addition, inserts are rust-proofed by sherardizing.

WATER LEVEL INDICATOR

Yarway has brought boiler water level readings down to the boiler room floor for the furnace operator's or water tender's constant, convenient checking by means of an ingenious trouble-free appliance, the Yarway Eye-Line water level indicator, as shown by Fig. 8. It employs as the actuating mechanism the same floatless principle with the displacement weights used so successfully in the Yarway Hi-Lo Alarm Water Column. A stainless steel tube extends down from the water column to the boiler room level. Here a standard Yarway Flat Glass Gage prominently displays a movable plunger or target which indicates to the furnace attendant the water level in the boiler above. This plunger is connected by a stainless steel or monel chain with the actuating balanced weights in the auxiliary column. The position of the target clearly shown through a Yarway Flat Glass Gage duplicates the exact position of the water level above.

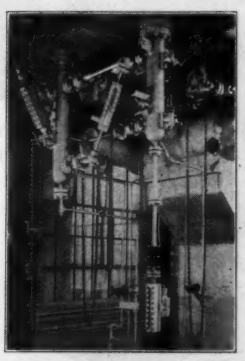


FIG. 8. THE YARWAY EYE-LINE WATER LEVEL INDICATOR.

Heaters and Feedwater Conditioning Equipment

COCHRANE CORP.
PHILADELPHIA, PA.

DURING 1931, Cochrane Corp. has developed an outstanding new line of equipment in our deaerating heaters.

This heater is the modern form of the open heater, but is in many respects greatly superior to the plain open heater. The water is heated quite to steam temperature without terminal difference and dissolved gases are expelled so that no trace of oxygen remains in the water as determined by the sensitive Winkler test. The elimination of terminal temperature difference results in higher plant efficiency, while the removal of oxygen protects piping, economizers, boilers and turbine blades from oxygen corrosion. The deaerating heater has a further advantage over an ordinary open heater in that it may be operated under any back pressure or vacuum or under variable pressure, adjusting itself automatically according to the relative amounts of steam and water delivered to it.

It is frequently installed as one of the bleed heaters in a regenerative feed heating system, connected preferably to a bleed point where the pressure is above atmospheric pressure, thus avoiding any possibility of air being reintroduced into the water once it has been deaerated. The deaerating heater can be equipped with any of the usual open heater accessories, including automatic makeup regulator, oil separator, automatic overflow or thermostatic temperature control. It can also be combined with a storage or surge tank, a V-notch feedwater meter, or a hot process water softener. The shell may be of cast iron with machined or calked joints, or of iron or steel plate with riveted or welded joints.

Cochrane Deaerating Heaters of each of these constructions have been built in capacities from the smallest up to and including 1,000,000 lb. per hr. The heater shown in Fig. 1 has a capacity of 160,000 lb. per hr. when receiving cold water. Deaerating heaters as a rule occupy less space than ordinary open heaters and cost about the same.

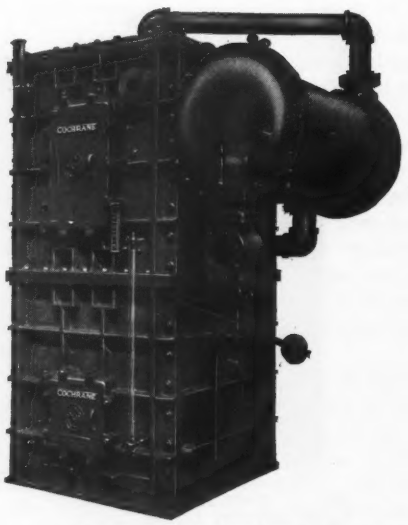
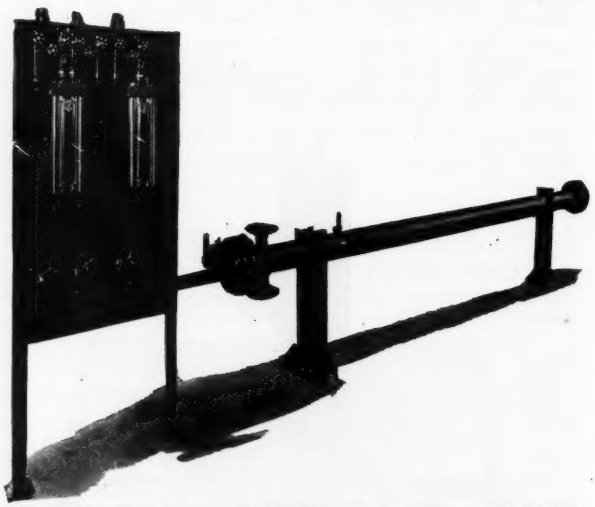


FIG. 1. COCHRANE DEAERATING HEATER

ELGIN SOFTENER CORP.,
ELGIN, ILL.

Continuous blowdown, heat recovery and control system shown in the accompanying illustration consists of a multiple type U-tube heat reclaimer and a precision control panel. The heat reclaimer is placed either in the boiler feed line, in the make-up or raw water line, or in any other water line where the heating of this water is desirable, as determined by the heat balance of the plant. The control panel is located at a convenient point in the boiler room or engine room. This system has recently been placed on the market by Elgin Softener Corp.



CONTINUOUS BLOWDOWN SYSTEM ARRANGED FOR THREE BOILERS

The Eckel precision control panel is built of steel and made with special flow-gages for measuring the flow of blowdown water from each boiler. These gages are of forged and machine steel, treated to prevent rusting, with pyrex indicating glasses ½ in. in diameter. They are built to be cleaned without shutting off the flow of blowdown. Directly below each of these gages are nitralloy-trimmed, forged-steel, hand-operated valves for controlling the blowdown from each boiler. The gages indicate the blowdown directly in U. S. gallons per minute. The control valves are located behind the panel, the stem, packing nut and hand wheel protruding through the panel.

The blowdown water, leaving the boiler at high temperature, passes to the heat reclaimer through a line of proper size. This heat reclaimer is designed to prevent flashing, as no throttling takes place in it, it is stated. Water from each boiler passes to the rear of the panel, through its individual control valve and orifice. After leaving the orifice, the blowdown flows to the discharge line.

ELGIN STEAM SPECIALTIES CO.,
ELGIN, ILL.

As a result of various methods of treating boiler feedwater, sludge may form in the boiler itself and this sludge must be removed before it reaches too high a concentration. This concentration, of course, is deter-

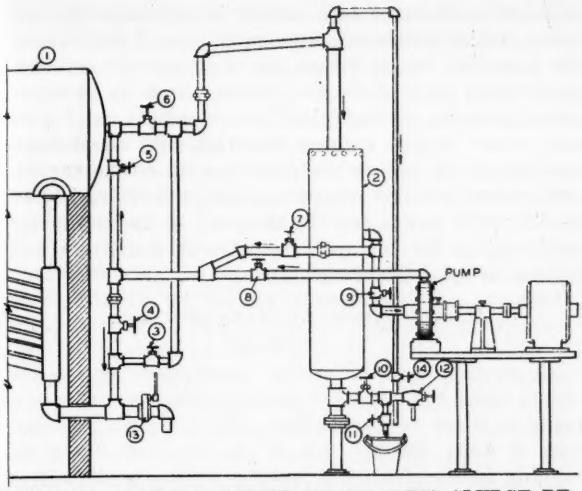


DIAGRAM OF ELGIN REITER CIRCULATING SLUDGE REMOVER

mined by a great many operating factors. To remove this sludge and reduce the concentration below the danger point as determined by the conditions of the boiler and to keep the boiler water clarified, the Elgin Reiter circulating sludge remover or deconcentrator has been developed and placed on the market by Elgin Steam Specialties Co., Elgin, Ill.

This system is constructed so that water may be taken from the bottom blowdown of the boiler and returned after clarifying to the boiler at the top, or it may be taken from near the surface of the water in the upper drum and after clarifying returned to the boiler through the blowdown pipe at the bottom.

FOSTER WHEELER CORP.,
NEW YORK, N. Y.

Recently developed lock head of the Foster Wheeler Corp. is an improved device for closing and sealing vessels which operate at high pressure. It is especially applicable to feedwater heaters, heat exchangers, boiler drums, reaction chambers and impregnators.

The lock head is designed so that the bolts holding the head in place carry none of the pressure within the vessel, and therefore, are not subject to strain or fatigue. The bolts which keep the gasket tight do not carry any of the pressure within the vessel, therefore, once they are made tight, pressure or temperature changes will not cause gasket leaks.

A high pressure feedwater heater in a modern central power plant has been fitted with the lock head. This heater, Fig. 4, operates at pressures up to 1800 lb. per sq. in. and temperatures as high as 700 deg. F. The heater has now been in operation about six months without a gasket leak.

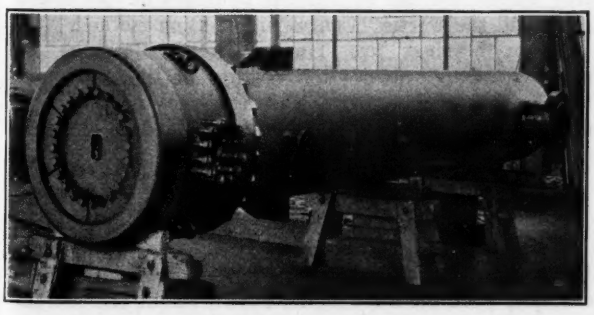


FIG. 4. FOSTER-WHEELER LOCK HEAD HEATER

THE NATIONAL PIPE BENDING CO.,
NEW HAVEN, CONN.

New and improved design of heating element called the National Freflo, for use with storage and instantaneous types of heaters, has been placed on the market by The National Pipe Bending Co. Letters patent have recently been granted on the design and construction of the Freflo heating element.

Its name Freflo is synonymous with its use, in that a definite proportional and unrestricted free flow to the heating medium through the tubes is obtained. This new design features the control of the relation of heating surface to the flow velocity of the heating medium, a basic fundamental in all heat transfer applications. It also features the use of pitched tubes and a distribution of heating surface proportional to length and capacity of storage tanks.

FIG. 5. FREFLO HEATING ELEMENT

A constant ratio of heating surface to flow area is maintained by the use of different diameters of tubing with corresponding different lengths. Small diameter of tubing of short lengths is used in the inner row or group, with larger diameter and longer lengths in each succeeding row or group. The use of pitched runs to the tubes and large flow areas proportional to lengths, prevents the forming of air or water pockets in the tubes and eliminates the collection of sediment.

Pumps and Compressors

ALLIS-CHALMERS MANUFACTURING CO.,
MILWAUKEE, WISC.

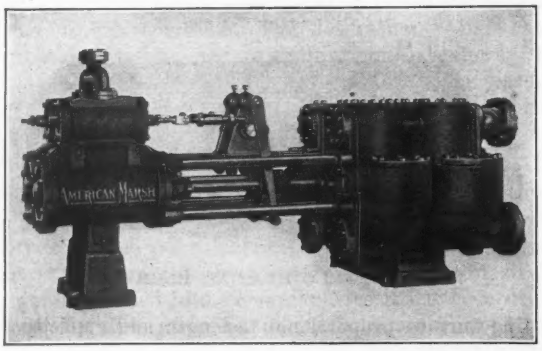
LATEST design of Allis-Chalmers Mfg. Co., condensate pump is axially balanced against end thrust and has full discharge pressure on the stuffing-boxes, preventing any inleakage into the condensate. A double suction impeller of special design for the high vacuum conditions is the first stage impeller and is located at the middle of the pump. This impeller discharges into two single suction impellers located at the ends of the pumps, each handling half of the water delivered by the middle impeller, and the discharge from the two second stage impellers is brought to a common outlet by suitable manifold piping.

Boiler feed pumps of latest design are double suction, multistage pumps inherently axially balanced against end thrust and designed in such a way that very substantial bolting of the top and the lower half casing can be secured permitting building of high-pressure boiler feed pumps of the split casing type. Special arrangements are also used to reduce the pres-

sure on both stuffing-boxes, and thrust bearings of a special air-cooled Kingsbury type are used eliminating the necessity for or complication of water-cooled thrust bearing.

THE AMERICAN STEAM PUMP CO.,
BATTLE CREEK, MICH.

Although the recently developed duplex piston pump shown in the accompanying illustration was designed primarily for oil refinery applications, the manufacturer, The American Steam Pump Co., Battle Creek, Mich., is also recommending it for boiler feed service. It is designed for 300 lb. working pressure at the steam end and maximum working pressure at the fluid of 400 or 500 lb. per sq. in. depending upon the size. Capacities of the pump range from 44 g.p.m. to about 240 g.p.m. and sizes from 6 by 3 by 12 to 10 by 6 by 18 in.



GENERAL VIEW OF DUPLEX PISTON PUMP

The steam end is of the balanced piston valve type. A cushion valve is provided at each end of each steam cylinder to give proper cushioning and to regulate the stroke of the pump. The pumps are equipped with balanced piston valves of the built-up type, having at each end two rings outside and one spring ring inside. The valve gear is of the standard duplex type equipped with adjustable links between the cranks and valve rods for setting the piston valves in working position, and for regulating the proper lost motion between the valve gear and the piston valve travel.

The fluid end is of the side pot, close clearance pattern with the two cylinders cast enbloc. The suction opening is located on the vertical center line at the end of the pump below the cylinders; the discharge opening, at the end of the pump above the cylinder head.

INGERSOLL-RAND CO., NEW YORK, N. Y.

A number of new sizes have been added to the Cameron line of small general service centrifugal motor-pumps manufactured by Ingersoll-Rand Co. These pumps are now made in one-inch discharge and upward. Pump and motor are assembled as a single unit with a common shaft, producing a compact, lightweight pump which requires little floor space and can be easily installed. No foundation or baseplate is needed. The discharge nozzle may be turned to any one of four positions.

There are only two bearings. These are of the ball type and require lubrication but once a year. There is but one stuffing-box, which is easily accessible. The impeller is made of bronze and is hydraulically balanced. Renewable bronze wearing rings and shaft sleeve are provided. These pumps are used against moderate heads for a great variety of services, such as in circulation systems, air conditioning equipment, stand pipe and water supply systems for factories, warehouses, apartments, swimming pools, condensate return system, and general transfer service handling a wide variety of liquids. The pump may be obtained in various motor combinations for all ordinary current conditions and for use in hazardous locations.

CURTIS PNEUMATIC MACHINERY CO.,
ST. LOUIS, MO.

A new line of industrial compressors, known as Curtis Model "C" Timken Bearing Compressors, is now ready to place on the market. The complete line consists of seven models, five of the two cylinder type, ranging in size from 4¼ by 3¾ to 6½ by 5, with a displacement of 25 to 125 cu. ft. and two of the four-cylinder type, a 5½ by 5¼ and a 6½ by 5¼ size with a displacement of 115 to 262 cu. ft. The compressors are designed principally for wide use in industrial and automotive plants and on road and building construction work. The model C Compressors are furnished by the Curtis Pneumatic Machinery Co., St. Louis, not only

FIG. 2. TWO NEW COMPRESSOR MODELS USING TIMKEN BEARINGS

as stationary simple compressors for belt drive from a line shaft, separate motor, steam engine or other prime mover, but are also furnished as complete self contained units, either direct connected or driven by multiple V belt. The compressors are likewise supplied with support wings instead of base mounting, when incorporated in portable units.

Outstanding among the design and construction features of the Model C Compressors, are the carbon-free valves, the use of Timken Bearings on the crank shaft and the Curtis "Centro-ring" oiling method.

Main bearings are Timken Roller Bearings, so mounted as to preserve the rigidity of the shaft and to take care of any thrust loads that may arise during operation. The use of Timkens has added to the efficiency and durability of the compressor.

WORTHINGTON PUMP AND MACHINERY CORP.,
HARRISON, N. J.

As a result of continued research to produce pumps for low head applications that compare favorably in efficiency with those for higher head services, the Worthington Pump & Machinery Corp. last year developed

an improved propeller pump designated the Type K. The unit has a cylindrical casing and the suction and discharge elbows are bolted to flanges at each end of the casing. It is the usual practice to drive the pump through the discharge end but, where necessary, it can be driven through the suction end.

Propeller shaft is supported on two bearings; an internal grease lubricated bearing which is located close to the propeller and a combined radial and thrust bearing of the anti-friction type mounted on the elbow. The internal bearing is supported in a spider inside the pump cylinder, on the discharge side of the propeller. The vanes supporting the bearing housing also function to guide the water leaving the propeller.

An important feature of the Type K pump is the form of the propeller. The hub is of a relatively small diameter, and the number and shape of the blades is such that the clearance between blades permits the passage of trash without clogging the pump. Trash cutters which are frequently employed with pumps of similar type are therefore unnecessary. The Type K pump can be arranged for either horizontal or vertical shaft drive. For the vertical shaft arrangement, a 90-deg. discharge elbow is usually employed and a suction bell mouth is attached to the bottom flange of the pump casing.

Vertical Triplex

Compactness is the keynote of a new line of vertical triplex single acting power high-pressure boiler feed pumps which have been developed by Worthington in 1931. The stimulus for developing this style pump has been the ever-increasing demand of the marine industry for minimum space and weight, and utmost reliability. To the end of conserving floor space, the pump is arranged for mounting the motor directly on top of the frame, the drive being accomplished by double reduction of gears which are enclosed in oil-tight gear guards in which lubrication is maintained at an adequate level. All bearings are pressure lubricated, and the pump is totally enclosed.

The main and pinionshaft bearings, of the roller type, are of primary interest. This design combines the paramount features of small space and weight, accesssibility and quietness, with the recognized high efficiency, reliability and control advantages of the displacement power pump. For installations having variable boiler demands, this design of pump, in combination with a direct current motor of 2 to 1 or even 4 to 1 speed reduction, is especially adaptable, an hydraulic excess pressure regulator actuating the field rheostat, thus controlling the motor speed in accordance with the boiler demands.

Although this line of pumps was originally designed in response to a demand of marine service, by virtue of the distinctive features which it incorporates, it fits ideally into the requirements of high-pressure stationary plants.

Deep Well Pumps

In the past year, Worthington has also revamped its line of rotating shaft deep well pumps. Making new patterns of stream line appearance for the driving heads, and incorporating in the driving heads a novel feature of a separate foundation plate with drop pipe flange resting upon the foundation plate, it now is possible to remove the driving head from the top of the well without disturbing any of the below-ground parts. Four new small-capacity wheels have been developed and existing patterns have been modified to increase the pump efficiency. Experimental tests, coupled with improved shop methods and inspection, have made it possible to build rotating shaft pumps for 6-inch wells to operate at 3600 r.p.m.

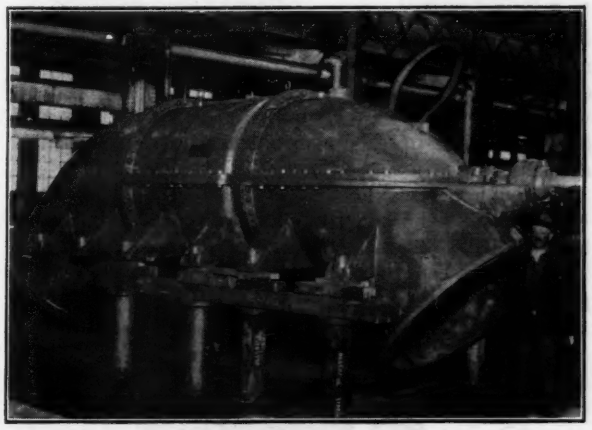


FIG. 3. A 110,000-GPM WORTHINGTON TYPE K PUMP

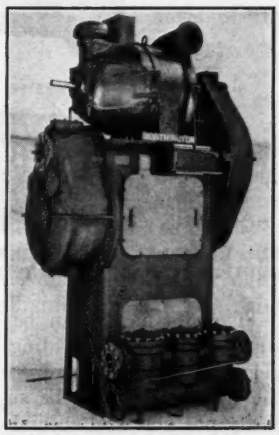


FIG. 4. A WORTHINGTON VERTICAL TRIPLEX BOILER FEED PUMP

Shorter rotating-shaft type vertical pumps for sump and irrigation duty have been modified by inserting a flared inlet at the bottom, which reduces inlet losses. On the larger capacity pumps, the drop pipe leading from the driving head to the impeller casing has been made cone shaped to reclaim velocity head and convert it into pressure. These improvements tend materially to increase the efficiency.

Rotary Pumps

Again the company has modified its patterns of rotary pumps, reducing the clearance between the rotors and providing free access so that the liquid can flow readily to and from the pump rotors. These changes have tended to reduce internal losses and increase the efficiency of the pumps. A large number of tests have been run with oils of various viscosities, and the effect of viscosity, speed, and pressure have been carefully studied. The results have been tabulated so that the engineers can select the correct size and speed of pump for the particular capacity, pressure and viscosity of the liquid.

Traps, Gaskets, Pipe Tools and Fittings

THE BORDEN CO., WARREN, O.

MODEL A BEAVER portable pipe machine, ½ to 2 in., recently placed on the market, is designed as an exceptionally simple, strong and convenient machine to cut thread and to ream ½ to 2-in. pipe of steel, wrought-iron, brass or cast-iron. With geared tools and extension shaft it is designed to handle pipe up to 12 in., according to its manufacturer, The Borden Co.

The automatic cutoff device follows in design the Beaver square-end pipe cutter. The machine is driven by a ½-hp. Universal motor, reversible at the switch. The motor is connected by a flexible coupling to insure perfect alinement.

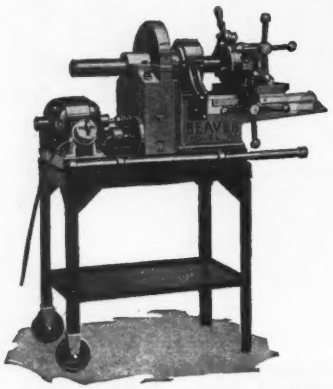


FIG. 1. MODEL A BEAVER WITH TWO WHEELED STAND EQUIPPED WITH SLIDING HANDLES FOR PORTABILITY

The die heads can be tilted back out of the way when cutting or threading with an extension shaft and geared die stocks or pipe cutters. The stand, shown in the illustration, can be supplied to make the machine easily portable and special dies are available for threading bolts, rods and the like.

CHICAGO FAUCET CO., CHICAGO, ILL.

For the wash room of a power or manufacturing plant, the shower bath is the most satisfactory and effective cleansing agency. In a new shower head put out by the Chicago Faucet Co. are embodied convenience, simplicity and low cost. From a single grooved nozzle a strong narrow jet of streams is thrown, giving the desired force for cleansing and invigoration with small water consumption and freedom from wide splashing. By loosening the face plate center nut, free flow of water washes out all sediment, while no dead pockets are left to drip after water is shut off. Executives in charge of hotel and institution equipment will also appreciate the water economy and the ease of maintaining these heads in satisfactory operation. General appearance is shown by Fig. 2 and details of the construction of ball joint, body and grooved nozzle disc by Fig. 3.

FISHER GOVERNOR CO.
MARSHALLTOWN, IA.

Increasing use and demand for strainers in all types of industrial machines opens a field for the Fisher Type No. 260-Y Strainer shown in Fig. 4. This unit was announced by the Fisher Governor Co. early this year. The superior points of the strainer are: it may be used in either vertical or horizontal pipe line; screen is easily removable and replaceable without distorting the screen; small drain plug for attaching blow-off pipe for cleaning strainer without disassembling. This strainer is regularly furnished with bronze body in all sizes from ¼ to 2 in.

FIG. 2. BROWNIE SHOWER HEAD

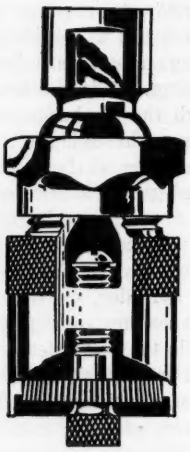


FIG. 3. SECTIONAL VIEW OF SHOWER HEAD AT RIGHT

APEX ST TRAP

The Apex Regulator Co., Marshalltown, Iowa, a division of Fisher Governor Co., announces, for the first time, a complete line of new steam traps of the inverted bucket type, having several new and exclusive features. This trap has exceptionally large capacities for body size and extra powerful leverage for positive opening and closing. The trap is so designed that the valve bucket or seat can be easily removed for inspection, cleaning, or changing without breaking the pipe line. This is a distinct advantage over the average inverted bucket trap and is one feature the manufacturers have found to appeal very much to the industrial user.

FLEXITALLIC GASKET CO.,
CAMDEN, N. J.

IN DESIGNING the improved manhole gasket shown in the illustration, the object of the manufacturer, the Flexitallic Gasket Co., of Camden, N. J., has been to obtain the greatest reusability. Construction of the gasket to bring this about is shown in the accompanying illustration.

In addition to the regular, soldered, double-thickness end-off at the outside, another completely soldered end-

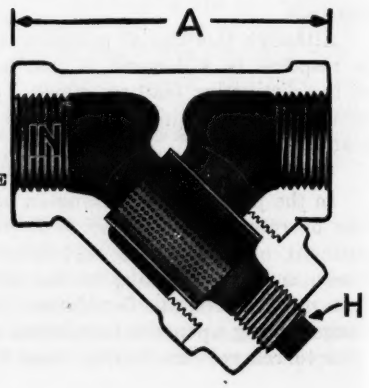


FIG. 4. FISHER TYPE NO. 260-Y STRAINER

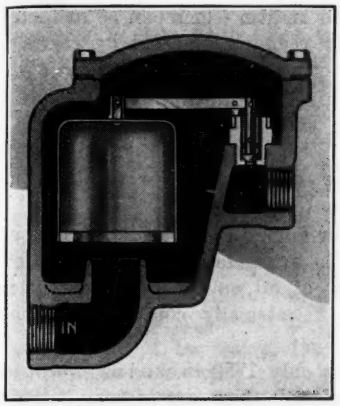
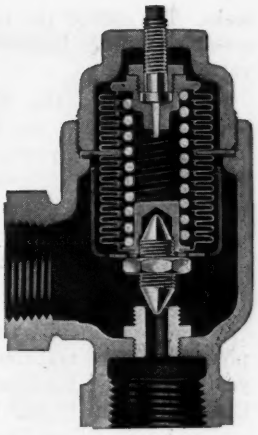


FIG. 5. NEW APEX CLASS ST TRAP

DETAILS OF CHEVRON PACKING



CROSS-SECTION OF TAGLIABUE TRAP SHOWING DIFFERENTIAL SETTING AND REVERSIBLE DISC

off is used a few plies inside this. If the final end-off, after service, shows any signs of wear, the outside plies can be removed so that the gasket will have another end-off and will still be intact with ample bearing surface. Besides the additional end-off, a double thickness metal reinforcement has been used at the center. This reinforcement is clinched and is designed to make certain that the gasket will not spread under pressure. This reinforcement is also intended to reduce strain on the outer plies of metal.

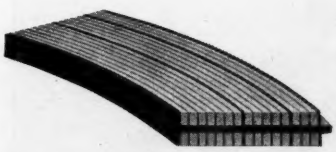
In making this gasket, the proper metal, such as stainless steel, copper, monel or whatever is best for the particular service for which the gasket is designed, is selected and a special device on the gasket winding machine then puts a V-shape, spring-like crease lengthwise in the strip. Two strips of asbestos ribbon are then fed, one on each side of the crease. All three strips are wound in one operation until the gasket has the right number of plies. In this winding, it is stated, the V-shaped crease in each ply locks with the crease in the ply next to it, the whole providing a tight flexible spiral, 19 plies to each inch and in the improved form having double thicknesses of metal at 4 places.

GARLOCK PACKING CO.,
PALMYRA, N. Y.

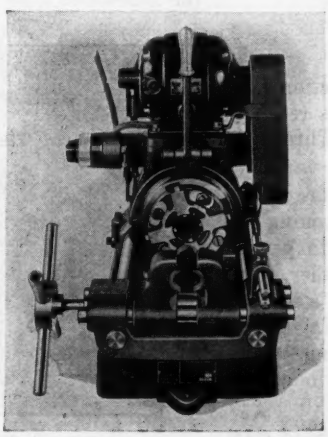
For packing rams and plungers of an accumulator, presses, pumps and other heavy duty hydraulic equipment, the Garlock Packing Co., Palmyra, N. Y., has developed a new packing known as Garlock 430 Chevron Packing, shown in the illustration. This is designed to be an automatic packing and built so that it will pack tighter as the pressure increases. The design is such as to permit the use of a plurality of rings in shallow stuffing-boxes that will not accommodate a suitable number of rings of other types of packing. This packing is furnished in ring sets only, and with each set of Chevron rings, top and bottom adapter rings are provided conforming respectively to the bevel of the gland and stuffing-box.

KAYE & MACDONALD, INC.,
WEST ORANGE, N. J.

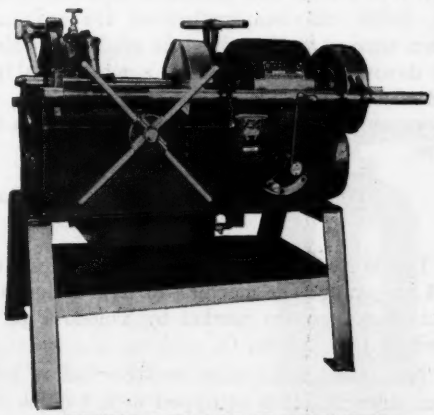
During the past year, Kaye & MacDonald, Inc., has made several improvements in its line of K-Master steam traps. Most important of which is that the K-Master modernized inverted bucket steam trap or the K-Master modernized ball float type trap may be furnished with either elbow outlet or tee outlet in place of the straight away outlet. This not only eliminates steam joints and steam fittings, but in the case of using the elbow outlet permits of easy access to the valve assembly and in the case of the tee outlet automatically furnishes a place for testing due to the fact that the K-Master modernized inverted bucket steam trap has no chance for concealed



CROSS-SECTION OF IMPROVED FLEXITALLIC MANHOLE GASKET



GENERAL VIEW OF THE NEW TOM THUMB PIPE MACHINE



TOLEDO 1 TO 4-IN. PIPE MACHINE

FIG. 11. TOLEDO RATCHET PIPE THREADER

leaks. The use of the tee outlet with a petcock makes possible positive inspection as to the tightness of the valve.

In addition, the K-Master modernized inverted bucket steam trap can be furnished with monel parts and stainless steel parts for pressures up to 600 lb. per sq. in. These high pressure steam traps have exactly the same features as the standard trap.

OSTER MFG. CO.,
CLEVELAND, O.

As a companion to its original Tom Thumb pipe and bolt machine, placed on the market last year, the Oster Manufacturing Co. and Williams Tool Corp., Cleveland, O., has just announced the new rotary die head Tom Thumb. The regular pipe capacity of the new machine includes all sizes from ½ to 1¼ in., with an extra capacity down to and including ⅛ in. Regular bolt capacity is ⅜ to 1¼ in. with an extra capacity of ¼ in., 5/16 in., 1⅜ in. and 1½ in. It can be furnished either as a bolt threader or with special equipment to handle nipples.

The machine is equipped with a stock-stop and an automatic trip to open the die head when the thread has reached any desired length. A hand trip is also furnished.

C. J. TAGLIABUE MFG. CO.,
BROOKLYN, N. Y.

Details of construction of a thermostatic steam trap recently placed on the market by the C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., are shown in the accompanying illustration. The differential setting feature is designed to make it possible for the trap to discharge condensate at a temperature corresponding to a uniform differential pressure from 0 to 20 lb. below the operating steam pressure.

When the differential setting screw is all the way up on the trap, there is no tension on the spring and the trap, it is stated, will discharge condensate from 1 to 2 deg. below the temperature of the operating steam. When tension on the spring is applied, by simply turning down the setting screw, a mechanical pressure is created on the inside of the bronze bellows, which aids the vapor pressure developed in the bellows to close the valve.

TOLEDO PIPE THREADING MACH. CO.,
TOLEDO, O.

Toledo No. 1-2-4—a high speed, high production 1 in. to 4 in. power pipe machine of new design has recently been placed on the market by Toledo Pipe Threading Machine Co., Toledo, O.

The frame is all steel construction to assure maximum strength. It is equipped with 8 quick opening die heads and dies, one for each size of pipe, to permit instant change of dies from one size to another. The dies are the rake type, made from high-speed steel and easily reground. The cutter head is of special design with 4 high speed steel cutter knives cutting simultaneously. The quick-opening die heads are to permit instant release of dies after threading.

Reamer is the cone-type with single high speed steel cutter blade, mounted on an arm which can be instantly swung into position for reaming and fed by carriage hand wheel.

Six spindle speeds are obtained through one clutch lever and gear shifting lever and all controls are managed by the right hand. Gears and friction clutch run in oil. The chip drawer is fitted in the front of the machine, easily pulled out and emptied.

Chuck wrench ejector fingers are provided to remove the wrench if it is left in by mistake. A centrifugal oil pump gives ample flow of oil on the dies and cutter knives. The reverse is electrically controlled by the switch.

This machine weighs only 1750 lb. and is equipped with a 220-440-v., 60-cycle, 3-phase a.c. motor.

Toledo has also brought out during the past year a small, compact ½ to 2 in. ratchet pipe threader known as the Toledo No. 12, and illustrated by Fig. 11. It has a separate die head for each size pipe; instant change from one size to another; and can be furnished for threading iron and steel or brass.

Valves and Fittings

GOLDEN-ANDERSON VALVE SPECIALTY CO.,
PITTSBURGH, PA.

DESIGNED TO ASSURE a reliable supply of water from emergency store for cooling of Diesel engine cylinders, in event of failure of regular water supply from any cause, several new Golden-Anderson valves, such as the automatic electric and automatic hydraulic, have recently been placed on the market. These are designed for installation in the emergency line connection so that they will remain tightly closed against the emergency supply until that supply is demanded, at which time the valve is designed to open instantly to permit the proper water supply for the requirement.

The automatic electric solenoid control valve can be furnished with a.c. or d.c. solenoid and is designed to require only a momentary closing of the circuit either to open or close the valve.

Cushioning effect is produced by air sucked into the annular space between the liner and piston.

The heavy bronze liner is also intended to form the seat. This, with the all-bronze piston, is intended to make the valve practically indestructible and to make the renewable liner and piston cup take all the wear.

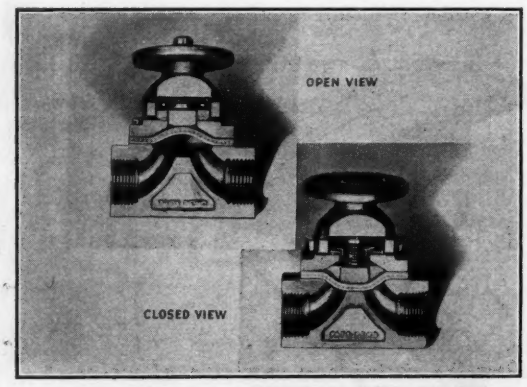


FIG. 1. NEW MILLS-McCANNA VALVE

These valves are furnished in either angle or globe patterns in 2 to 24-in. sizes with flanged ends, also in heavy and extra heavy pattern for standard and extra heavy pressure. The automatic hydraulic valve is furnished in the same size 2 to 24 in. with flanged ends and the interior construction of the valve itself is much the same as that of the electric valve, the difference is in the operating mechanism. The valve is installed in the emergency supply line with a ½-in. diaphragm pipe connection made through the discharge side of the service pump between check valve and pump discharge. In the event of pump failure or current interruption, thus reducing the pressure at the pump discharge below the adjustment of the valve, the unbalanced pressure on a diaphragm actuates the valve to admit emergency supplies. Another valve of the same general type as these two is the automatic cushion water reducing valve for maintaining constant delivery pressure on distribution mains. These are all products of Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.

Hills-McCanna Co., Chicago, Ill.

Hills-McCanna Co. has acquired manufacturing and sales rights on a valve that was designed and perfected by P. K. Saunders, a mining engineer in South Africa. The valve was originally intended to eliminate leaks in water and air lines that caused a large unnecessary expense each year. Ordinary valves with metal to metal seats were not satisfactory, due to scale and other foreign substances settling on the seats preventing a tight closure.

The valve Mr. Saunders perfected has no metal to metal seats, no stem packing or stuffing-boxes, and is recommended for general service. The materials handled never reach the valve bonnet. The diaphragm protects all the working parts from the substances handled. This is a big feature when handling volatile liquids, gases and air, liquids having gritty solids in suspension and corrosive liquids. Access to the bonnet or body does not require removal from the line.

In the closed position, the diaphragm is compressed between the compressor follower and the seat. An even distribution of pressure on the diaphragm is secured through proper design and machining of the seat and compressor.

J. E. Lonergan Co., Philadelphia, Pa.

New pop safety valves Model OHP, manufactured by the J. E. Lonergan Co., for use on oil field boilers is made with the spring completely encased and protected from contact with steam as shown by Fig. 2. This prevents the deposit of salt on the spring where saline water is used. The valve is made with Benedict bronze seats, discs and adjustable rings. The body is of malleable iron or bronze. It is suitable for 350 lb. pressure. For use in connection with superheated steam, this valve is also made with an exposed spring all-steel body and nickel-alloy seat, disc and ring as Model EOWS.

A pop safety valve Model WTGT with gas-tight cap and lever as shown by Fig. 3 is also among the new

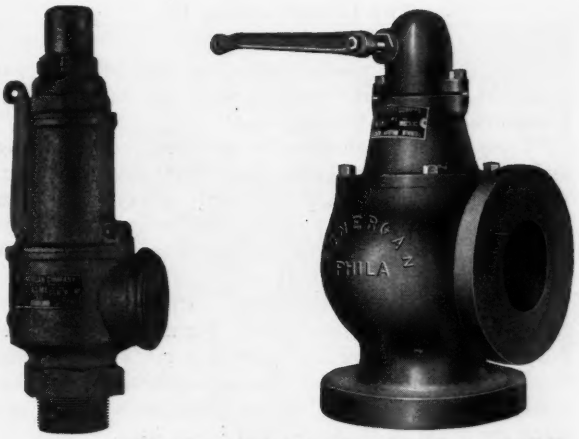


FIG. 2. (LEFT) LONERGAN MODEL OHP VALVE
FIG. 3. (RIGHT) LONERGAN MODEL WTGT VALVE

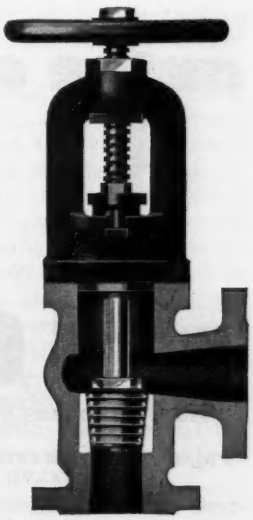
products of this company. This valve is made in cast iron for pressures up to 300 lb. and of steel for higher pressures.

Ludlow Valve Mfg. Co., Troy, N. Y.

To reduce the effects of erosion in a valve, the Ludlow multi-valve shown here has been designed on the principle of reducing the pressure across the valve in steps to secure a low pressure differential across a number of successive and independent seating contacts.

The design is intended to afford a metal on metal seating that will cut through scale and viscous liquids and to insure a positive shut-off that will not simmer. It is also intended to provide a multi-stage opening action that reduces velocity and density by successive expansion and cushioning and to give throttling action without erosion. The multi-seat principle is employed to insure a tight seat with all fluids, at all temperatures and pressures, that prevents distortion and cleans its seat at each closing.

These valves are made by the Ludlow Valve Mfg. Co. of Troy, N. Y., for blowoff service, throttle service, drain and stop valves



VIEW SHOWING PRINCIPLE OF MULTI-VALVE

THE LUNKENHEIMER CO.,
CINCINNATI, OHIO.

Two new steel needle valves for high-pressure gas or liquid service have recently been developed by The Lunkenheimer Co., Cincinnati, O.

These valves are designed to give accurate throttling and regulation at pressures up to 3000 lb. at 150 deg. F. The construction is exceptionally heavy with extra long pipe threads. They are used extensively, it is stated, on orifice meters for measuring gas and on other high pressure instrument lines.

Valves are identical in design, with steel body, hub, stem, stuffing box nut and gland. Figure 2 has bar steel body and is Parkerized. Figure 1 is made of stainless steel and is intended for use in localities where corrosive fumes are present in the atmosphere. Both patterns are made in ⅛, ¼, ⅜ and ½-in. sizes.

READING-PRATT & CADY CO.,
BRIDGEPORT, CONN.

Lubrotite gate valve, incorporating the lubricant-seal principle of tight seating, is a valve for general industrial uses. In this valve a duct system is used for introducing a lubricant-seal between the seating surfaces. The valve is sealed tight, it is claimed, even though the seating surfaces have become damaged by scratches, deposits or corrosion in the line.

Lubricant-seal separates wedge from seats slightly, freeing wedge that has become set from a long period of service, it is claimed.

The valves are made in both Pratt & Cady Standard and Extra Heavy Iron Body Patterns, and in Reading Electric Cast Steel by the Reading-Pratt & Cady Co., Inc., Bridgeport, Conn. The general dimensions are the same as the nonlubricated valves, so Lubrotite valves can be used for replacement service without changing the piping system in any way.

HENRY VOGT MACHINE CO.,
LOUISVILLE, KY.

Drop Forged Steel globe, angle, gate and check valves are designed to be used for various cold working pressures ranging from 1500 to 3000 lb. per sq. in. and for pressures from 600 to 1500 lb. per sq. in. at 900 deg. F. These valves are furnished with either flanged or screwed ends.

Valves are drop forged from solid steel billets of carbon steel and its alloys. As all parts are machined from solid steel forgings, defects commonly found in other methods of manufacture are eliminated. The completed valves are tested with high pressure air, oil or steam to insure proper performance in the service for which they are designed and recommended. All valves can be furnished drop forged entirely of stainless steel or only the parts that come in contact with the corrosive agent can be drop forged of stainless steel. The outside parts can be furnished of carbon steel.

In this complete line of drop forged steel valves will be found types especially suited for power plants, chemical plants, refineries and other industries where strength, durability and resistance to corrosion and erosion are required.

DROP FORGED STEEL FITTINGS

Drop forged steel tees, ells, and crosses are now made by the Henry Vogt Mach. Co. with screw ends in sizes from ⅛ to 6 in. and with flanged ends in sizes from ¾ to 6 in. Flange unions for 500, 1500, 4000 and 6000 lb. cold working pressures. Companion flanges for 125, 150, 300, 600, 900, and 1500 lb. W.S.P. Also 45-deg. laterals, street ells, union tees, union ells, screwed and flanged ells, screwed unions, plugs, bushings, couplings and caps. Drop forged steel automatic liquid gage cocks for high or low pressures and temperatures.

YARNALL-WARING CO.,
PHILADELPHIA PA.

Recently developed for use in general service by Yarnall-Waring Co. are Yarway Type P Seatless Valves.

Utilizing a sliding piston that cuts through highly viscous liquids and solids suspended in solution, this valve closes tight without the usual danger of foreign matter jamming the valve seat. The harder the handwheel is turned after the valve is closed, the tighter the valve becomes, due to the transmission of this pressure through the upper and lower glands to the packing rings. When the valve is opened a clear unobstructed passage is provided without projections to accumulate deposits of materials being handled, or to slow up viscous liquids.

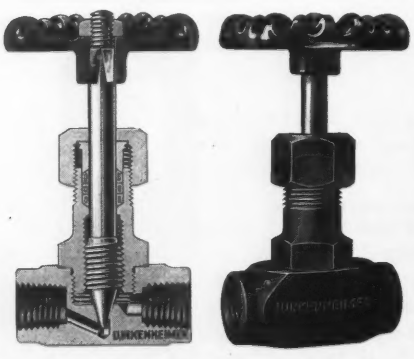


FIG. 1. STAINLESS STEEL VALVE

FIG. 2. CARBON STEEL, PARKERIZED VALVE

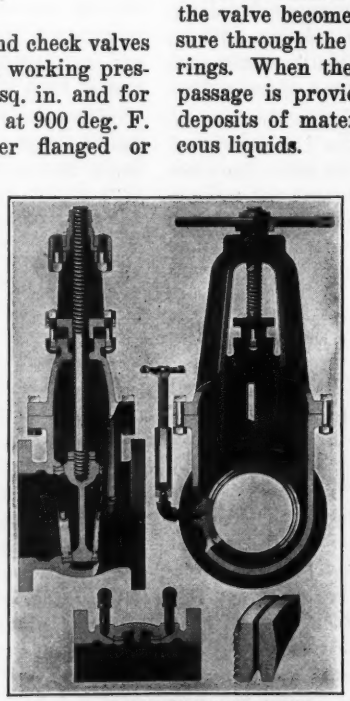


FIG. 3. LUBROTITE VALVES

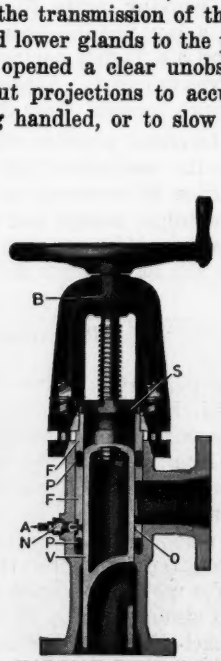


FIG. 4. YARWAY TYPE P VALVE IN CLOSED POSITION

Prime Movers *that cut the* Station Heat Rate

Steam Engines and Turbines

ALLIS-CHALMERS MFG. CO.,
MILWAUKEE, WIS.

ALLIS-CHALMERS MFG. CO.'S 115,000-kw. tandem compound unit which is unit 6 in the Waukegan Station of the Public Service Co. of N. Ill. and which was under construction at the end of 1930 has now been installed and has been in successful operation for several months. A photograph of this unit is shown by Fig. 1.

A single cylinder unit of 30,000-kw. capacity has been installed and placed in operation in the plant of the Wisconsin Power & Light Co., Sheboygan, Wis. This unit is built to operate at a steam pressure of 650-lb. gage and 800 deg. F. total steam temperature.

The 80,000-kw. tandem compound turbine for 1230-lb. gage steam pressure, 825 deg. F. total temperature, 29 in. vacuum, for The Milwaukee Electric Railway & Light Co.'s Station at Port Washington is now under construction; the unit will be installed in 1932.

Work on the design of the 125,000-kw. unit for the Chicago District Electric Generating Corp., State Line Station, is almost completed and shop work is progressing.

Research and development work during the past year has been continued along the lines of improvement in blading construction and along the lines of general improvement in reliability in operation based on careful observation of large units in operation.

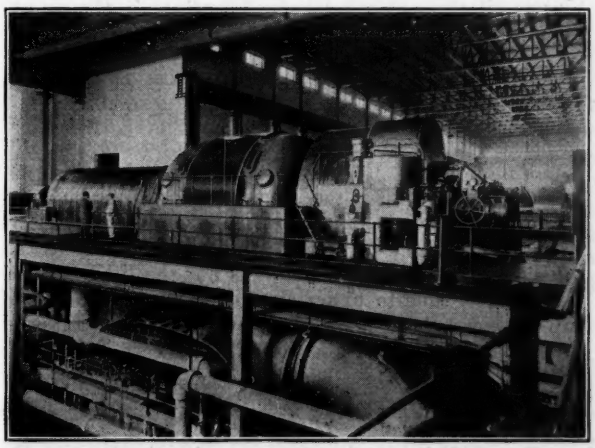
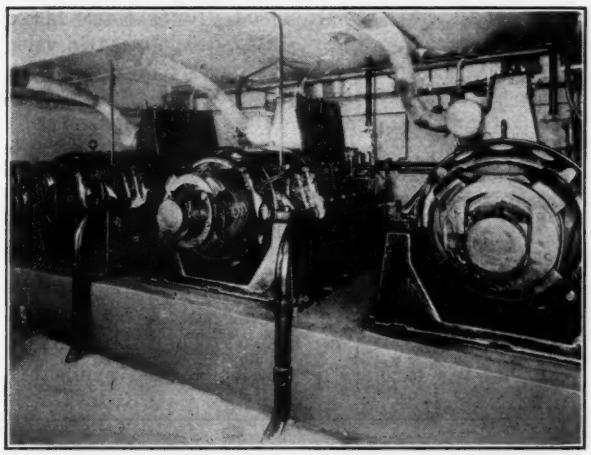


FIG. 1. ALLIS-CHALMERS 115,000-KW. UNIT NO. 6 AT WAUKEGAN



HOTEL CHELSEA AUTOMATIC DIESEL PLANT

GAS COMPRESSORS

This company has supplied to the Garfield Natural Gas Co. two compound steam engines driving gas compressors. These machines will deliver natural gas from the Kentucky-West Virginia fields to Washington, D. C., through a 500-mi. pipe line.

Engines are of the cross compound type, each having one 25-in. h.p. cylinder and one 52-in. l.p. cylinder, both 42-in. stroke. The high pressure cylinders are equipped with drop piston valves and the low pressure cylinders with standard Corliss valves. Each engine drives two double acting, single stage gas compressors having a normal capacity of 15 mil. cu. ft. of free gas per 24 hr. delivered at an ordinary pressure of 425 lb. per sq. in. The engines will operate at variable speeds up to a maximum of 120 r.p.m. and have a normal b.-hp. of 1500 and a maximum of 2700 b.-hp. depending on the inlet gas pressure.

MOORE STEAM TURBINE CORP.
WELLSVILLE, N. Y.

The Moore Steam Turbine Co. builds many turbines to meet special and complex conditions. Typical complex conditions are illustrated by the following three turbines now driving Ingersoll-Rand gas compressors at the West End Works, Jersey City, of the Public Service Elec. & Gas Co. and which meet the following conditions: Designed steam pressure 350 lb. 100 deg. F. superheat; first bleeder pressure 125 lb.; must either bleed or admit steam at 10 lb. pressure under control of a mixed pressure bleeder governor; exhaust at 28 in. vacuum; normal loads, 500 to 760 hp. at 3500 to 3700 r.p.m.; maximum load, 1480 hp. at 4500 r.p.m.; speed controlled by a gas pressure governor interconnected with an oil relay 4500-r.p.m. turbine governor; must carry normal loads non-condensing; as the 350 lb. boilers are not yet installed, the turbines are built with special first stage nozzles, and with one stage and the 125-lb. bleeder omitted they carry the same loads at 100-lb. steam pressure.

The following protective devices are installed: Over-

speed governor set at 10 per cent overspeed; closes main and overload governor valves; closes 10 lb. control valve; closes automatic trip and throttle valve; closes trip valve in 10 lb. steam line; breaks vacuum. Failure of oiling system starts auxiliary lubricating oil pump; closes main and overload governor valves; closes high pressure and 10 lb. trip valves. Constant speed governor limits turbine speed to 4500 r.p.m., but allows gas governor to control at any lower speed.

These turbines adjust the demand and supply of 10-lb. steam and will also bleed 125-lb. steam to supply existing apparatus after 350-lb. boilers are installed.

Special Application

At the Ford Motor Co., River Rouge plant, this company has two turbines driving boiler feed pumps and

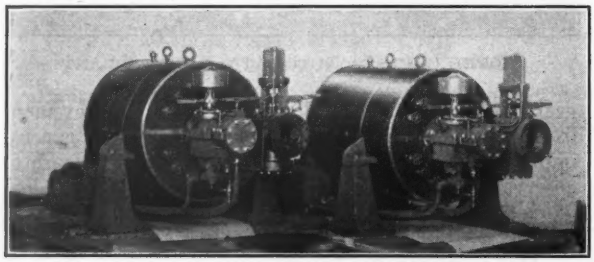


FIG. 2. (ABOVE) TWO MOORE TURBINES FOR THE FORD PLANT

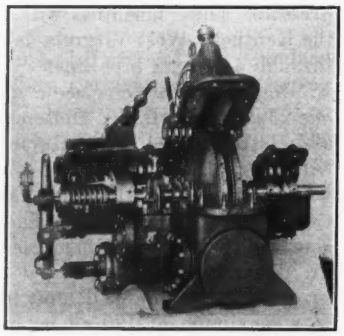


FIG. 3. (RIGHT) A NEW TYPE SMALL MOORE TURBINE

arranged for instantaneous automatic starting. These turbines, Fig. 2, are rated at 1000 and 1250 hp. respectively at 1750 r.p.m. Steam conditions are 225 lb. 654 deg. F. and 5 lb. back pressure. These multi-stage turbines are all steel, with adequate provision for expansion and show no distress under the shock conditions imposed on them.

New Small Turbine

We offer a turbine designed for small powers but having all of the mechanical features recognized as essential in larger turbines but not all previously available in turbines of comparable size. We refer to: Horizontally split casing; carbon packing; governor wearing parts of hardened tool steel; emergency governor with independent trip valve; babbitted, bronze backed bearings; bearings protected by felt lined oil baffles; water cooled bearing cases; stainless steel governor valve, seats and stems; heavy blading of nickel steel, or stainless steel according to operating conditions; wheel diameter large enough for good economy; hand valve for overloads up to 50 per cent.

The illustration, Fig. 3, shows a turbine with cast iron casing. Steel casing with center line support and lagging is also available for high steam pressure and temperature.

The E. H. Wachs Co., Chicago, Ill.

Built in a range of sizes from 2 to 65 hp. for speeds up to 1150 r.p.m. and for pressures up to 250 lb. with or without superheat, the Type R vertical heavy duty steam engine shown here has recently been developed and placed on the market by The E. H. Wachs Co. of Chicago, Ill.

This engine is built fully enclosed and self-oiling. The piston valve, travels in a removable cage having machined admission and exhaust edges. Steam passages are short and direct, to reduce clearance volume and friction.

The piston is cast hollow and graphitic iron rings are provided, while the rod is of alloy steel, ground

FIG. 4. WACHS TYPE R ENGINE

and threaded for attachment to crosshead. The valve gear is a straight line mechanism as shown in the illustration with the eccentric built so that reversal of engine rotation in the field can be accomplished.

All reciprocating and revolving parts are lubricated automatically at the first revolution of the engine by a plunger pump operated from the crankshaft, which draws oil through a submerged strainer in the crankcase.

Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Perhaps the most significant Westinghouse turbo-generator of the year was a 600-lb. pressure unit for the Public Service Co. of New Jersey, rated 22,500 kv-a. at 3600 r.p.m. This is the largest machine ever built for this speed, which is, of course, the maximum possible to use in generating electricity at the usual 60 cycle frequency. This 22,500-kv-a. unit is not the limit, for designers feel able to undertake generators of this speed up to more than 30,000 kv-a. with internal fans, or double that figure with such aids as external fans and aluminum field coils. The tendency to high speed, of course, springs from its substantial advantages in space, weight, and efficiency.

Two 2000-kw. turbo-generators for the Dupont Co. represent a curiously interesting return of high-fre-

quency power. It was as high frequency (133 cycles) that the alternating current first made electric service generally available forty-six years ago. The 180-cycle energy of the new generators will be used, not for general service but for extremely high-speed spinning buckets which make artificial silk, buckets driven by two-pole, 10,000-r.p.m. induction motors. Frequencies down to 120 cycles are available by speed variation of the turbine.

To the Boston Elevated goes what is near the largest 25-cycle unit which can be built and shipped complete. Though shipping clearances limited the width to 130 in., it was possible by special design, welded construction and exceptional ventilation, to use stator punchings 105 in. diameter. The unit is unusually short in length, its efficiency is notably high; and its exciter was designed to harmonize in appearance with the general lines of the set.

GENERAL ELECTRIC CO.,
NEW YORK, N. Y.

During the year, there were installed for the Brooklyn Edison Co. and for the Ford Motor Co. two General Electric Co. large-capacity turbine-generators that are radically different in design and yet both are typical of recent developments in the turbine industry.

At the Hudson Avenue Station of the Brooklyn Edison Co. the 160,000-kw. unit installed is a tandem-compound turbine driving a single generator at 1800 r.p.m. The steam at 400 lb. pressure and 730 deg. F. total temperature enters the high-pressure turbine and exhausts from it into a double-flow low-pressure turbine at a variable pressure determined by the load on the unit. The 160,000-kw., 200,000-kv-a. generator is more than 50 per cent larger in capacity than any previous 1800-r.p.m. generator.

The blowers that circulate the cooling air through the generator are mounted on top of the generator and a common housing covers both the generator and the blowers while at each side this housing is wide enough to contain the surface air coolers.

The 110,000-kw. 1200-lb. vertical-compound unit for the Ford Motor Co. is ready for operation in its River Rouge Station. Steam reheaters in which 1200-lb. steam direct from the boiler is used to reheat the steam exhausted from the 1200-lb. high-pressure turbine. This exhausted steam, after being reheated to 550 deg. F. total temperature, enters the double-flow low-pressure turbine.

There is a growing tendency to locate the generator surface air coolers at each side of the generator inside of the housing as an integral part of the generator installation and facilities were extended so that now such air coolers can be readily produced in lengths suitable for the largest generators.

A 4000-kw. unit shipped to the Ohio State University, is provided with a speed governor equipped with a floating fulcrum that eliminates speed regulation in the governor. The unit operates over its range of load with zero speed regulation and with a variation at any load of less than one-tenth of one per cent.

The Iowa Railway & Light Co. was supplied with three noncondensing turbines having a special governing arrangement whereby the units operate back-pressure governed, as long as the frequency of the system remains constant. If the frequency drops the frequency meter changes the machines to speed governing.

Internal Combustion Engines and Auxiliaries

ALLIS-CHALMERS MFG. CO.,
MILWAUKEE, WIS.

DURING THE YEAR, several interesting installations have been completed and placed in operation by the Allis-Chalmers Mfg. Co. Six gas blowing engines have been installed in the Illinois Steel Co.'s South Chicago Works, the largest gas blowers the company has built. Each engine is of the twin tandem type, having four double-acting gas cylinders, 48 in. in diameter by 60 in. stroke and two air cylinders 82 in. in diameter by 60 in. stroke. Each engine has a capacity of 52,100 cu. ft. of air delivered at from 20 to 25 lb. pressure when operated at 78 r.p.m. Three engines are required to furnish air for two 1000 t. blast furnaces.

An additional 6600-kw. gas-electric unit has also been placed in operation in the South Chicago Works of the Illinois Steel Company. This engine is of the twin tandem four-cylinder double acting type similar to two units previously installed in the same plant. The cylinders are 60 in. in diameter by 64-in. stroke.

MCINTOSH & SEYMOUR CORP.,
AUBURN, N. Y.

As in past years, the year 1931 has seen further extension of the Diesel engine field, particularly by virtue of increased speeds and decreased weights. The McIntosh & Seymour Corp. has during the past year, brought out several series of engines, extending the line both in smaller sizes and in larger sizes. Particularly the smaller sizes have been developed, incorporating higher speeds and lighter weights, so that new uses in the marine and the railroad field, as well as the stationary field have developed. The use of aluminum alloys as well as steel alloys has also tended to reduce weights.

PICKERING GOVERNOR CO.
PORTLAND, CONN.

In addition to its well known line of steam governors, the Pickering Governor Co., of Portland, Conn., is also making several new models for internal combustion engines. The G. P. and G. P. Jr. are already in extensive use on various types of installations.

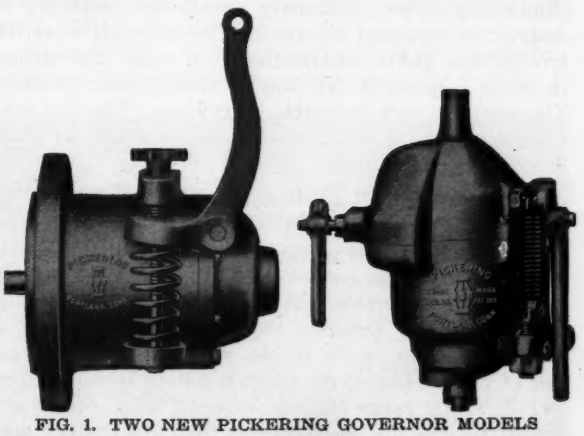


FIG. 1. TWO NEW PICKERING GOVERNOR MODELS

Model G. P. Junior is designed for horizontal position, the usual mounting being on the timing gear plate. This model is especially recommended for high speed

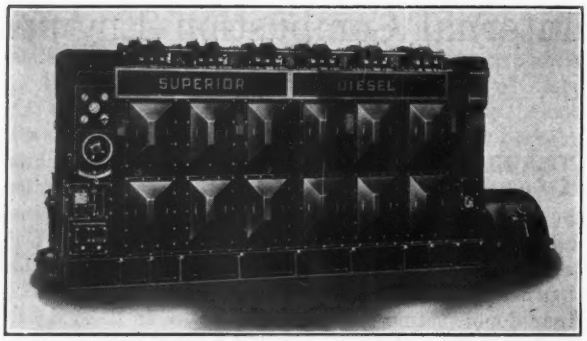


FIG. 2. SUPERIOR ENGINE GENERATOR SET

engines of smaller bore and stroke. It has an adjustable speed changer. It is also equipped with ball bearings and operates in a bath of oil and is extremely compact.

Model G. P. is designed for vertical mounting, especially for gas engines of medium and large sizes, and has recently been adapted to use on some of the smaller Diesels. It is particularly suited to conditions where high engine efficiency and fuel economy are important factors. With a wide governing range, it gives extremely close regulation at any set point. Equipped with ball bearings throughout, it has practically no wearing parts, insuring long life. Lubrication is accomplished either by splash or feed from the engine. The model illustrated shows provision for remote control where the engine is used for variable speed conditions.

SUPERIOR ENGINE CO.,
SPRINGFIELD, OHIO

Latest model Superior Diesel engine direct connected to a.c. generator is shown by Fig. 2. The six-cylinder engine illustrated, 12 by 15 in. size is rated at 350-b.hp., at 360-r.p.m. and in 14 by 18 in. size is rated 512-b.hp. at 327-r.p.m. They are built in a range of powers from 50-65 hp., up to 700-840 hp.

These four-cycle, airless injection Superior Diesels are of enbloc construction combining compactness and moderate weight with great rigidity and strength. The cylinders have easily removable liners of durable material. The shafts are large in diameter, shorter and stiffer, eliminating at any customary speeds the possibility of destructive torsional vibration. The camshaft is at the level of the heads, eliminating push rods. The design in many respects is far simpler than former practice. The engine is very accessible everywhere. The fuel consumption from ¾ to full load is between 0.38 and 0.40 lb. fuel oil per b.hp.-hr.

WORTHINGTON PUMP & MACHINERY CORP.
HARRISON, N. J.

Designed with the primary object of producing maximum profit for the user—taking into account first cost, depreciation, renewals and repairs, fuel and supplies, attendance and outages—the Worthington Pump & Machinery Corp., early in the year, announced a new line of vertical four-cycle, direct injection Diesel engines, Fig. 3, with a range of from 50 to 1000 hp. Speed and torque ratings are moderate so that the engines may run continuously at full load without adverse effect on the power cost. In fact, continuous operation at full load is not only permitted but also recommended.

Pressure lubrication, individual fuel pumps for each cylinder (controlling fuel injection hydraulically without push rods or levers), cylinders individually water-jacketed and removable cylinder liners are a few of the many important refinements of these new engines.

GAS ENGINES

The ever increasing number of industrial centers in which natural gas is available—at rates which make power production by gas engines economically competitive—was the principal reason for the recent introduction of a new line of vertical four-cycle gas engines shown in Fig. 4. A reliable and convenient source of power, these engines are built with from 2 to 8 cylinders with a range of from 60 to 1000 hp.

In construction, this engine closely parallels the vertical four-cycle direct injection Diesel engine described above. Among the many outstsanding features of these new gas engines are: Each cylinder is individually water-jacketed; pressure lubrication; removable cylinder liners; camshaft removable at right angles to the engine; and all cylinder heads can be removed at one time without disturbing manifold.

Condensers and Auxiliaries

ALLIS-CHALMERS MFG. CO.,
MILWAUKEE, WIS.

DURING THE YEAR Allis-Chalmers Mfg. Co. has placed in service its largest surface condenser, in connection with the 115,000-kw. turbine in the Waukegan Plant. The condenser shell is of the oval type, 12 ft. deep by 24 ft. wide by 25 ft. long, contains 80,000 sq. ft. of surface and will condense 778,000 lb. of steam per hour. The condenser contains 14,000, ⅞ in. dia. tubes 25 feet long (a total length of 66 miles) and the circulating water is supplied by two Allis-Chalmers motor driven centrifugal pumps having a total capacity of 132,000 g.p.m.

An important welded steel condenser installation has been made consisting of two 96 in. diameter by 20 ft. long, single pass condensers, each containing 13,000 sq. ft. of surface and serving 22,500-kw. turbines.

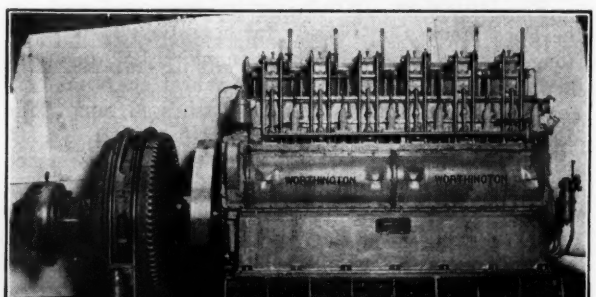


FIG. 3. (ABOVE) WORTHINGTON DIESEL ENGINE

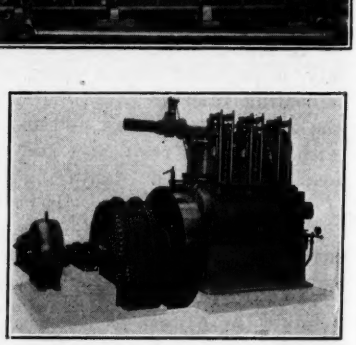


FIG. 4. (RIGHT) WORTHINGTON GAS ENGINE

MARLEY CO.
KANSAS CITY, MO.

Multi-Blade indirect-connected fan for forced draft cooling towers, designed by the Marley Co., Kansas City, Mo., now is being used exclusively in this company's forced draft tower designs. The peripheral or tip speed of the multi-blade fan is cut in half to provide for more quiet operation. High efficiency is obtained at this slow speed, it is claimed, by multi-blading and by reason of the larger diameter of the fan.

All blades of this new fan are individually mounted on a common hub and designed to be easily adjustable or removable to meet actual operating conditions.

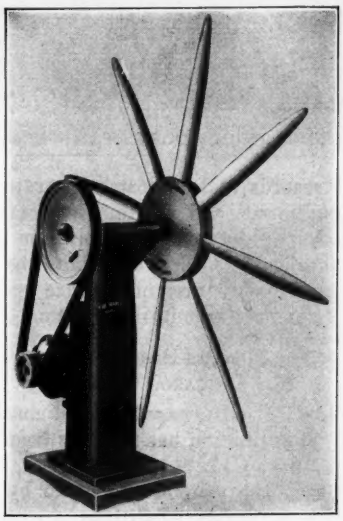


FIG. 1. MARLEY MULTI-BLADE FAN

In addition to the multi-blade fan, the Marley Co. also is introducing a new direct-connected fan for use where requirements are for higher pressures or for smaller fans with reduced volumes. This direct connected fan also is of comparatively large size for fans of this type.

SCHUBERT-CHRISTY CORP.
AFFTON, MO.

Induced draft water cooling tower designed to give maximum efficiency at lowest possible operating costs has recently been placed on the market.

Fans are located at the top of the tower to produce a uniform flow of air throughout the tower. The possibility of ice forming on fan blades is eliminated as the fans handle the warm exhaust air only. By the elimination of fan houses, the foundations are simplified and space requirements greatly reduced. The design of the tower, it is stated, is such that the usual fan noises are effectively silenced

Multi-speed remote control of the fans is used to permit the proper adjustment to suit any load or weather condition with a corresponding lowering of power consumption. Large natural draft openings are employed to make it possible to shut down the fans entirely for a large portion of the year.

The induced draft tower is constructed by Schubert-Christy Corp., Affton, Mo., of cypress or redwood of select grade specially treated with a wood preservative of high penetrating power.

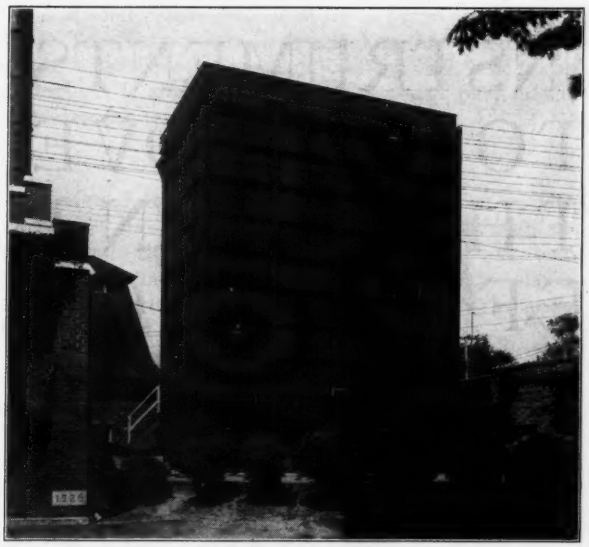


FIG. 2. FANS ARE AT TOP OF THIS SCHUBERT-CHRISTY TOWER

WORTHINGTON PUMP & MACHINERY CORP.
HARRISON, N. J.

One of the outstanding developments in condenser design and construction was the 101,000-sq. ft. single shell surface condenser built by the Worthington Pump & Machinery Corp., for the Hudson Avenue Station of the Brooklyn Edison Co. for use in conjunction with a 160,000-kw. General Electric turbo-generator. The world's largest of its type, this condenser embodied many unusual features. Some idea of the size of this new condenser may be realized from the fact that it contains nearly 15,000 Admiralty metal tubes, each 7/8 in. in outside diameter and 30 ft. long. When the water spaces are filled as in normal operation, the weight of the installed condenser is approximately 608 tons. From turbine exhaust flange to basement floor below hotwell—the total height of the condenser is 34 ft. Tube heads are 21 ft. in diameter cut off at top and bottom to 17 ft. 3 in. The water boxes are divided vertically to permit one-half of the condenser to be cleaned while the other half is in operation.

In addition to the condenser itself, Worthington furnished all auxiliary condenser equipment for unit No. 7.

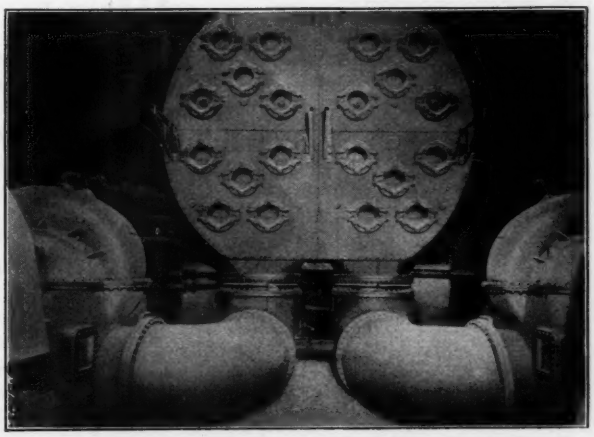


FIG. 3. 101,000 SQ. FT. WORTHINGTON CONDENSER INSTALLED AT HUDSON AVE.

INSTRUMENTS TO IMPROVE THE PLANT EFFICIENCY

Boiler Instruments and Pyrometers

BAILEY METER CO.,
CLEVELAND, O.

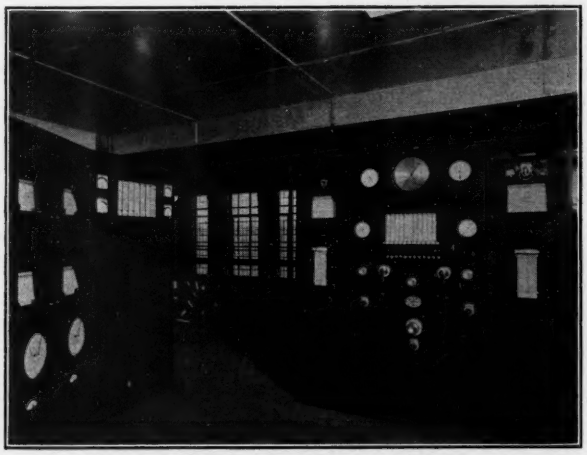
BAILEY RATIO METER has been developed for use as a combustion guide in the firing of gas or oil fired heaters, kilns and all types of industrial furnaces. Its primary purpose is to provide furnace operators with an easily understandable guide which will enable them to maintain a definite relation between the amounts of air and fuel supplied to the furnace so as to obtain higher combustion efficiency. This is accomplished by an ingenious method. Referring to Fig. 1, it will be noted that the meter contains two recording pens.

One pen records the rate of fuel flow; the other pen records the flow of air to the furnace. At the time the meter is installed, a complete combustion test is run on the furnace to determine what ratio between air flow and fuel flow corresponds to best combustion conditions and the air flow mechanism is then adjusted so that this ratio is always obtained when the two records coincide, one upon the other.

In addition to serving as a combustion guide, the Bailey Ratio Meter is valuable as a fluid meter on the fuel line. It records and indicates the rate of flow in any convenient terms, and the total flow may be given by the four dial integrator which may or may not be installed in the meter, as desired. Thus the meter furnishes daily graphic pictures of furnace operation, and supplies data for cost accounting systems.

FIG. 1. BAILEY RATIO METER

FIG. 2. BURGESS-PARR CALORIMETER



INSTRUMENTS IN MOORES PARK STATION

BURGESS-PARR CO.,
CHICAGO, ILL.

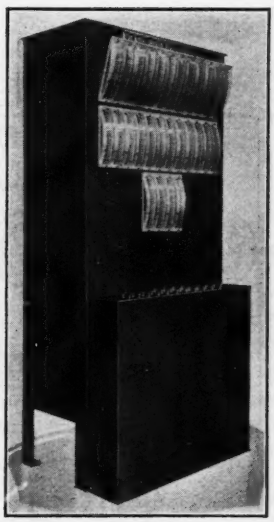
New model of the Burgess-Parr Adiabatic Calorimeter for fuel determination has recently been announced by the Burgess-Parr Co.

By employing the method developed by Dr. S. W. Parr, complete adiabatic conditions are easily maintained throughout a run, it is stated, thus eliminating the time required for determining radiation correction factors and eliminating much computation. Radiation is prevented by maintaining the jacket temperature at all times equal to the calorimeter temperature, using manually controlled streams of hot and cold water for this purpose. In this way water of the proper temperature is introduced into the jacket and is circulated on all sides, top and bottom, so that radiation from the calorimeter cannot occur.

In addition, the instrument is provided with two matched and certified thermometers, a motor mounted on the jacket to provide power for stirring the calorimeter and for circulating the water in the jacket, an ignition system connected directly to a 110-v. source and a pilot light to indicate the duration of ignition. The calorimeter is provided with the Illium Bomb. In addition to the calorimeter's use for fuel analysis, it finds applications in the chemical research laboratory, in which instance the complete adiabatic conditions provided by the jacket are particularly necessary.

HENRY L. CROWLEY & CO.,
W. ORANGE, N. J.

Ceramic claimed to possess the lowest coefficient of thermal expansion of any known material, is announced by Henry L. Crowley & Co. Known as Crolite No. 7, the new ceramic enjoys a two-to-one advantage in thermal coefficient over Invar, an alloy heretofore representing the lowest thermal coefficient, and a four-to-one advantage at 100 deg. (two-to-one at 1000 deg. F.) over



FIGS. 3, 4 AND 5. NEW HAYS INSTRUMENTS (LEFT, ABOVE) AUTOMATIC COMBUSTION INDICATOR (RIGHT, ABOVE) 28 POINTER STOKER CONTROL PANEL (RIGHT) TYPE J POINTER DRAFT GAGE

Sillimanite, the ceramic employed for spark plug cores and other purposes.

Crolite No. 7 has a coefficient of thermal expansion of 0.9 at temperatures ranging from 0 to 100 deg. C., and 1.2 from 0 to 200. At high temperatures, or up to 1000 deg. C., the coefficient of thermal expansion is 2.7. Invar is 1.5 for temperatures from 0 to 100 deg. C. The thermal expansion curve of Crolite No. 7 is absolutely smooth and uniform. The new ceramic has certain critical applications, such as in precision instruments where changes of material must not upset characteristics. Also, it may be employed for spark plug cores and other uses, particularly pyrometer tubes, where heat shock is severe.

FOXBORO CO.,
FOXBORO, MASS.

Designed for extreme accuracy and freedom from the effects of ambient temperature (case and tubing temperatures) the new Anti-ambi recording thermometer has been developed recently by the Foxboro Co. of Foxboro, Mass.

This new recording thermometer is designed to give true bulb temperatures at all times irrespective of summer heat or winter cold. The case and tubing may be enclosed in a cabinet and the temperature changed rapidly or slowly up and down for 50 deg. and it is claimed that the pen will remain perfectly steady. The thermometer is designed for use on temperature ranges up to and including 250 deg. F.

A special construction feature is found in the small bulb. The thermometer is designed so that it can make use of a sensitive bulb as small as one inch long. This feature, it is stated, will be found useful particularly in measuring temperatures in pipes.

THE HAYS CORP.,
MICHIGAN CITY, IND.

Designed to provide continuous indication of CO_2 only; CO_2 and furnace draft; CO_2, furnace and uptake draft, and CO_2, furnace draft and flue gas temperature, the new automatic combustion indicator shown at the left in the accompanying illustration has recently been placed on the market by the Hays Corp.

The CO_2 indicator is similar in design to the Hays CO_2 recorders and employs the Orsat principle of operation. The power unit for the draft attachment is colon leather mechanism such as is used in Hays pointer gages. The flue gas temperature indicator is designed for ruggedness and operates on the thermo-electric principle, similar to those used in the Hays portable combustion test sets.

At the right of the accompanying illustration is shown a recently developed control panel carrying 28 especially designed differential type draft gages. This panel was especially designed for use with the zone control type Taylor Stokers. For each power unit there is an air-tight case and molded glass front. Indicating pointers move parallel to the scale face to eliminate parallax.

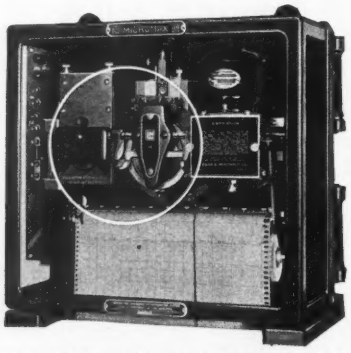
Numerous improvements have been made in Hays Flue Gas Analyzers and a more extensive line of Portable Combustion Test Sets is being offered for general plant testing and for field work by consulting engineers, service men and installation engineers. Our pocket type portable draft gage is now equipped with a convenient reel for winding the rubber tubing without kinks.

Several additions to the Hays Line of Combustion Efficiency Appliances have been developed during 1931. An Automatic Combustion Indicator for CO_2, Furnace Draft and Flue Gas Temperature for use where records are not required or desired makes an Orsat analysis for CO_2 every one and a half minutes with the accuracy and dependability of the automatic recorder. The indicator may be mounted flush on panels or it can be equipped with legs for wall mounting. It is also available as a portable instrument mounted on three wheels with a handle which lowers the instrument on to legs when desired. Our slack leather diaphragm mechanism for draft, pressure and differentials is now offered in a smaller junior Type "J" cast aluminum case. One or two scales and pointers can be mounted in this case and it is also possible to seal the case air tight and use our simplest mechanism to indicate differential draft or pressure. Gages of this type are being used as air filter gages to show when a filter needs cleaning and as flow indicators for low pressure air or gas. A new line of U-Tube Manometers with cast aluminum frames and pyrex glass tubes has been introduced and also a line of direct reading Manometers. The U-Tube Manometers use either water or mercury as the indicating liquid while the direct reading manometers use red oil in most ranges although the Jumbo Type for higher pressures employs mercury. One other new instrument which has just been introduced is the Hays oxygen recorder. This operates on the accurate Orsat principle and one charge of chemical will give several months' service.

LEEDS & NORTHRUP CO.,
PHILADELPHIA, PA.

Introduction of an improved potentiometer pyrometer has been made by the Leeds & Northrup Co. of Philadelphia, Pa. The instrument has been named Micromax to distinguish it from the preceding Potentiometer Pyrometer of this company.

Micromax pyrometer is designed to be sensitive, rugged, and fast in operation, to be fully automatic and to eliminate daily attention and adjustments. These advantages are obtained, it is claimed, by the new



MICROMAX PYROMETER, SHOWING BALANCING AND STANDARDIZING DEVICES

mechanical balancing device, shown in the accompanying photograph, and the automatic standardizer, also shown, designed to check the instrument circuit every 45 min. or less.

Micromax balancing device is built to give micrometer sensitivity, to need no adjustments and to be remarkably fast-acting. Due to the complete elimination of operating clearance between galvanometer pointer and levers, pointer deflections as small as 0.001 in. can be detected and recorded. The recording pen is designed to step across the entire 9⅞ in. of calibrated chart in less than 22 sec., the size of each step being closely related to the extent of pointer deflection. The non-slip driving clutch for the pen is direct and simple and is automatically prevented from attempting to move the pen beyond either end of the scale.

General Instruments and Control Equipment

AMERICAN DISTRICT STEAM CO.,
NORTH TONAWANDA, N. Y.

ADSCO ROTARY condensation meter in two small sizes, one with 250 lb. capacity per hr. and the other 500 lb. per hr. are now being placed on the market by the American District Steam Co. of North Tonawanda, N. Y. These meters are similar in design to the larger ADSCO Rotary meters designed for use on district heating and industrial steam lines. Briefly described, the rotary is a bucket type meter, containing six identical buckets locked in position at the rotor axis. As the buckets are filled, the weight of the condensate causes rotation, discharging the buckets and bringing empty buckets successively into position for filling. The revolutions of the rotor are transmitted to the dial, which registers the measurement in pounds.

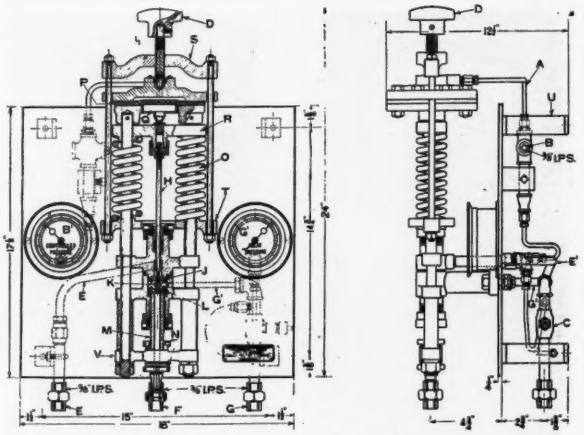


FIG. 1. BAILEY STYLE G RELAY PRESSURE VALVE

BAILEY METER CO., CLEVELAND, O.

One of the latest developments of the Bailey Meter Co. is a relay pressure valve known as the Style G, which is designed to give extremely accurate pressure control of steam, water or gas lines.

Briefly, the relay valve, illustrated by Fig. 1, controls the pressure within close limits by regulating the movement of a sylphon operated or piston operated throttle valve installed in the line in which the pressure is to be controlled. A minute change in the controlled pressure will result in a relatively large change in the motive pressure used to operate the regulating valve.

Due to an exclusive feature enabling change of the seat gap by adjustment of micrometer adjusting nuts "M" and "N", it is possible to obtain any desired speed or lag in amplified pressure connection "G". The application of this valve is unlimited, as it can operate one valve, a series of valves or pistons.

THE BRISTOL CO., WATERBURY, CONN.

A new direct reading, single pen absolute pressure gauge of the recording type, has been developed by The

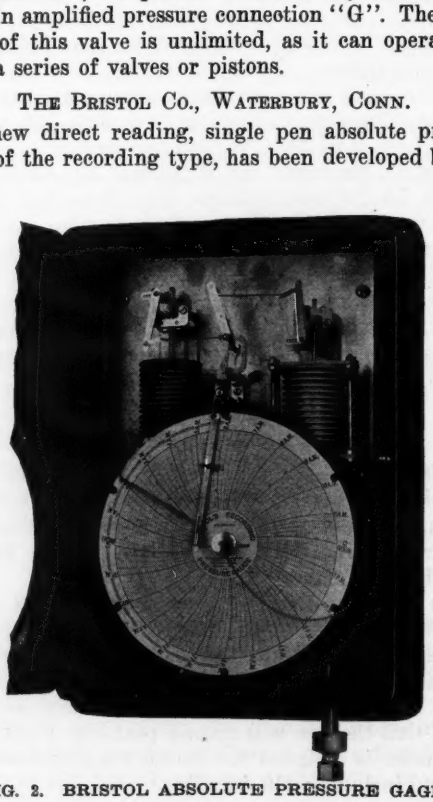


FIG. 2. BRISTOL ABSOLUTE PRESSURE GAGE

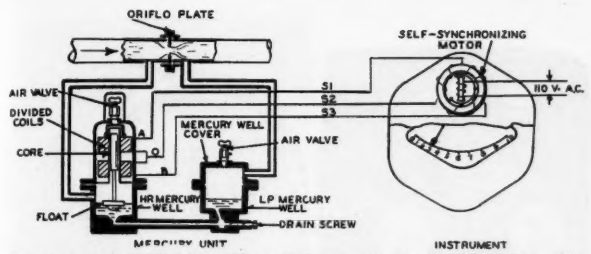


DIAGRAM SHOWING THE PRINCIPLE OF OPERATION OF TYPE EB ORIFLO METER

Bristol Co. The use of high vacuum is an important factor in many production processes. This instrument now offered eliminates any possibility of confusion or delay, resulting from applying barometric corrections to vacuum readings. This instrument can be furnished for ranges as low as from 0 to 50 millimeters head of mercury pressure absolute or equivalent.

Such an instrument gives important information for purposes of control in connection with operation of turbo condensers, vacuum pans in sugar and salt drying, vacuum oil stills.

The actuating mechanism consists of two extremely sensitive diaphragm elements. One is connected to the vacuum line, and the other is directly affected by barometric pressure variations. The resulting movements of these elements are transmitted by a differential transmitting linkage to a single penarm which permanently records on a suitable chart.

Builders Iron Foundry, Providence, R. I.

Electrically operated, type EB Oriflo meter designed for measuring flow of steam, air, gas, water, oil or other fluids in power plants and industrial plants, has recently been placed on the market. The complete meter, a recent product of Builders Iron Foundry, Providence, R. I., consists of the differential producer, the mercury unit and the instruments. For the differential producer there may be used either an oriflo plate, a Venturi tube or a Venturi nozzle. The differential producer selected is connected to the mercury unit by the usual pressure pipes and the mercury unit transmits the differential movement electrically to the instrument located a any convenient distance.

An improved form of the self-balancing inductance bridge, in which a self-synchronizing motor replaces the secondary coils, actuates the type EB meter. As shown in the diagram, any change in the rate of flow produces a rise or fall of the mercury unit and a corresponding movement of the bakelite float. An attached core of transformer steel moves inside the divided primary coils in the mercury unit. These coils are connected to a suitable source of alternating current. The indicator hands or chart pen in the secondary instrument are connected by linkages to the rotor of the self-synchronizing motor and the rate of the flow is indicated on the dial or chart by the position that the hand or pen assumes when the rotor turns to balance the electrical circuit.

Ellison Draft Gage Co., Chicago, Ill.

Liquid level gage for elevated tanks vented to the atmosphere has recently been placed on the market. A mercury U-column is used to measure directly the liquid head or static pressure corresponding to varying levels in the tank, balancing an equivalent column of mercury against the liquid head obtaining.

One leg of the U-column terminates in an indicating pointer gage having mechanism known as the Ellison straight-line movement. When the liquid pressure is exerted on the mercury column, the mercury is depressed in the reservoir, rises through the small tubing and flows into a well in the gage.

Movement of the mercury in the well actuates a plunger attached to the beam. The pointer, it is stated, gives a true indication of the liquid level over the entire range of a straight-line scale of uniform spacings.

This gage, a new product of Ellison Draft Gage Co. of Chicago, Ill., is illuminated from the interior and may be mounted on panel, flush or semi-flush, or on wall with vertical or tilted scales to obtain best visibility.

General Electric Co., Schenectady, N. Y.

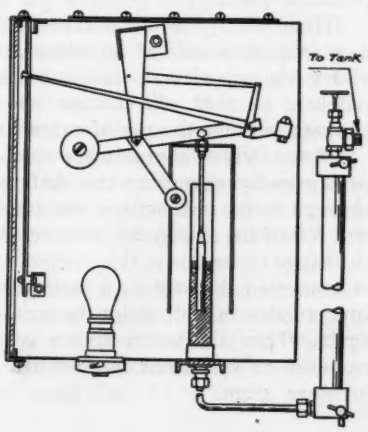
The Thermotel, a General Electric device for making rapid and accurate surveys of transformer loads, has been changed so that a double calibration makes it possible to apply one instrument over practically the entire range covered by General Electric distribution transformers. The instrument indicates directly the per cent of available distribution transformer capacity actually being used, and, when safe load conditions are exceeded, shows a conspicuous danger signal, easily seen from the ground.

Provision for double calibration by shifting an external lever makes each instrument applicable to transformers as small as 5 kv-a. and as large as 200 kv-a. When the transformer has been subjected to unsafe loads, in excess of 100 per cent rating, a white semaphore is tripped into view.

Two models are available. Type 8K1A1 is installed by unbolting the transformer cover, slipping the instrument support over the edge of the tank, and replacing the cover. Type 8K2A1 is installed by screwing into a nipple in the side of the transformer. In G-E subway transformers, the lower oil-level-indicating plug is replaced by the Thermotel, the auxiliary plug of the Thermotel permitting checking of oil level as before.

Republic Flow Meters Co., Chicago, Ill.

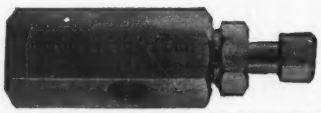
Developments during 1931 by Republic Flow Meters Co., in the line of metering equipment for the power field, have been concerned largely with making refinements in the present instruments which tend toward even greater efficiency, both as to the operation of the instruments and their installation and maintenance.



CROSS-SECTION OF ELLISON LIQUID LEVEL GAGE WITH STRAIGHTLINE MOVEMENT

MARTIN-DECKER CORP., LONG BEACH, CAL.

DESIGNED to dampen out slow or rapid pulsations of either liquid or gas, at any pressure range, on indicating or recording gages for pumps, compressors, steam lines, pressure controllers, orifice meters, draft gages and other types of pressure measuring devices, the utility model pulsation dampener shown here has recently been placed on the market by Martin-Decker Corp. of Long Beach, Calif. It is made in one size, which is designed to handle any pulsating pressure from a few inches of water to several thousand pounds.



UTILITY PULSATION DAMPENER

NEILAN CO., LTD., LOS ANGELES, CAL.

Simplified pressure control instrument (non-recording type) has just been announced by Neilan Co., Ltd., of Los Angeles, Calif. This new instrument is made to control pressures accurately in ranges from 0 to 5000 lb.

The Neilan controller has been greatly simplified in design so that the average plant operator can easily adjust or repair it. It embodies such advanced features as the Neilan compound pilot valve and the sliding wedge actuating block designed to enable any degree of sensitivity to be obtained at any point on the instrument's pressure range.

WARREN TELECHRON CO., ASHLAND, MASS.

An industrial timer for use in connection with piece rate production has been devised by the Warren Telechron Co. The timer is turned on and off by a relay in the circuit to the motor of the machine the output of which is being timed. The relay is so arranged that, if the motor is not running or is running under light load, the timer will not operate. When the machine is operating, however, the increased load on the motor causes the relay to turn the timer on and the actual working time of the machine is recorded.

WESTINGHOUSE ELEC. & MFG. CO., PITTSBURG, PA.

To indicate pressure readings at a remote point for use with supervising control systems, Westinghouse Elec. & Mfg. Co. has developed a multi-contact electric transmission system having 10 adjustable contacts placed at predetermined intervals over the scale of the pressure gage.

When the pressure changes sufficiently to make a new contact, a code of impulses is sent over the supervisory control wires to indicate the change to the dispatcher, so that all changes are automatically sent through without the use of extra live wires.

Motor driven contacts are made to follow the pressure gage by extending the shaft of the pressure gage through to the rear with a contact mounted on it which will follow the change in pressure. As the pressure tends to change up or down, this contact strikes another which is connected directly to a motor-driven shaft which in turn rotates in a direction to cause the contact to open again. Thus the motor-driven contacts will rotate in response to variations in pressure as indicated by the pressure gage.

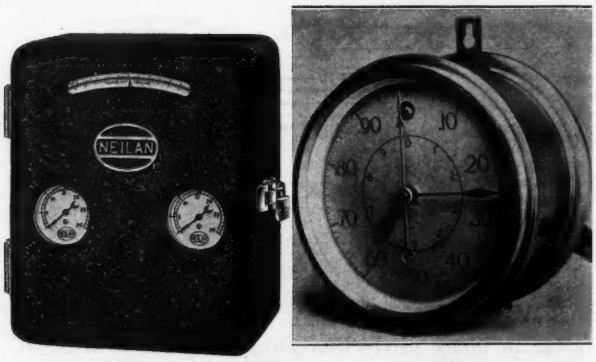
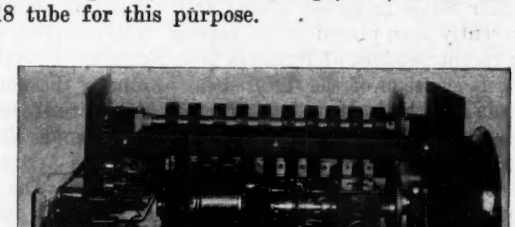


FIG. 6. THE NEILAN CO. CONTROLLER
FIG. 7. (RIGHT) WARREN TELECHRON TIMER

Maximum pressure in the cylinder of a Diesel engine must often be determined to adjust valves. One method of measuring this pressure is to use a small instrument screwed into the cylinder wall like a spark plug. It contains a contact mounted on a diaphragm and another contact just above it and insulated from the rest of the instrument. Engine pressure acts on the lower side of the diaphragm, tending to bend it upward and close the contacts, while the chamber on the upper side is connected to a compressed air line through a pressure gage. The pressure of the air is brought up from a low value until it just balances the pressure in the cylinder, at which point the contacts remain open.

The grid glow tube provides a means for securing visible indication of such an operation and requires a contact lasting only a small fraction of a second. The device shown has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., to use the KU-618 tube for this purpose.



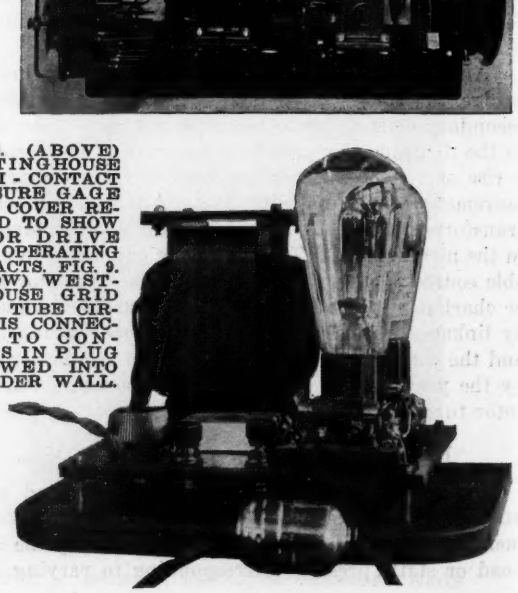


FIG. 8. (ABOVE) WESTINGHOUSE MULTI-CONTACT PRESSURE GAGE WITH COVER REMOVED TO SHOW MOTOR DRIVE AND OPERATING CONTACTS. FIG. 9. (BELOW) WESTINGHOUSE GRID GLOW TUBE CIRCUIT IS CONNECTED TO CONTACTS IN PLUG SCREWED INTO CYLINDER WALL.

ELECTRICAL EQUIPMENT *to* MODERNIZE the Plant . . . . .

Switches and Starters

EXPLOSION-PROOF across-the-line starting switches, of both the oil-immersed and air-break type, are a recent development of the Allen-Bradley Co. These switches are used with squirrel-cage motors and slip-ring motors, on 3-phase or 2-phase 3-wire systems, as well as self-starting single-phase motors, in oil refineries, chemical plants, mines, and wherever inflammable gases or vapors are liable to be present. The maximum ratings are 25 hp. at 110, 50 hp. at 220, and 100 hp. at 440-550 v. When used with slip-ring motors, these switches are for primary control only.

The oil-immersed switches are available with ratings of 50, 100, and 150 amperes. The air-break type of switch is available only in the 50 ampere size. All switches have two magnetic overload relays, and the contactors are equipped with copper-to-copper rolling-type contacts as well as magnetic blowouts and arc shields.

CUTLER-HAMMER, INC., MILWAUKEE, WIS.

FOR USE in connection with squirrel cage induction motors, Cutler-Hammer, Inc., has recently developed a new explosion proof, across-the-line starter.

Distinguishing this new starter from similar explosion proof equipment is the immersion in oil of its new thermal overload mechanism. It differs from the usual immersed oil dashpot relay and three-pole magnetic contactor in that a newly designed thermal overload mechanism is used with the contactor.

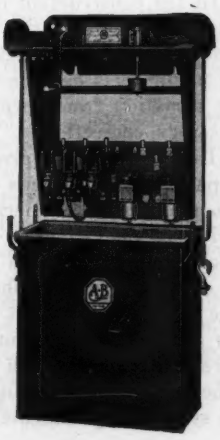
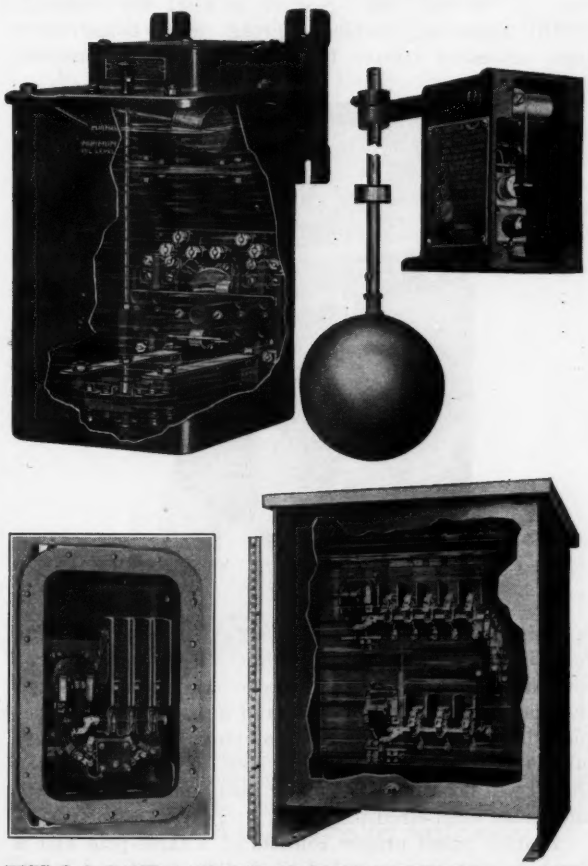


FIG. 1. ALLEN-BRADLEY STARTING SWITCH

Being completely oil immersed, the starter is corrosion resisting and therefore suitable for chemical plants and cement mills. General applications are: dry cleaning establishments, oil refineries, gasoline pumping stations, lacquer spray rooms, gas plants, flour mills, grain elevators, starch mills, sugar mills, coke plants, etc.

Cutler-Hammer, Inc., also announce a new, explosion proof, across-the-line type, A.C. automatic starter for applications where explosive gas or dust is prevalent in the atmosphere, such as dry cleaning and dyeing plants, gas plants, gasoline filling stations, coke plants, starch and flour mills, oil fields, refineries and chemical plants, etc. This new starter is of the air break type; all contacts are made and broken in the air; there is no oil tank. The heavy cast-iron, explosion proof, enclosure is designed to prevent any explosion which might occur within it, from igniting the surrounding explosive atmosphere. These starters are designed in three sizes, to take care of motors up to 30 hp. 220 v. and 50 hp. 440 or 550 v.



FIGS. 2, 3, 4 AND 5. CUTLER-HAMMER EQUIPMENT. (UPPER LEFT) ACROSS-THE-LINE STARTER. (UPPER RIGHT) FLOAT OPERATED STARTER. (LOWER LEFT) AIR BRAKE STARTER. (LOWER RIGHT) OIL-IMMERSED A.C. STARTER.

For small alternating current and direct current motors on cellar drains, sump pumps, open tanks and similar application, the new float operated motor starting switch provides across-the-line starting and thermal overload protection with small size.

This is a single-pole starter with double-break, silver contacts to assure continuous current carrying capacity. Contact mechanism is quick make and break. The operating lever and shaft are reversible in the case and the operating lever can be shifted to any angular position of the shaft, so either tank or sump operation can be obtained with the starter mounted in any position.

The thermal overload relay protects the motor from burnout and prevents unnecessary blowing of fuses. It is free tripping—the switch cannot be held closed on an overload. When the overload trips, it is necessary for someone to go to the switch and return the operating lever to the full "off" position to reset the overload.

Oil immersed, explosion-proof, auto transformer type automatic starter for a.c. squirrel cage motors,

FIG. 6. ELECTRIC CONTROLLER CO. MOISTURE AND VAPOR-PROOF STARTER

is designed to comply with Underwriters' requirements for Class 1, Group D installations, it is built to provide a six-inch head of oil above the contacts and to incorporate oil level indicator and outside spout for replenishing the oil without removing the cover. Terminals are located above the level of the oil so that the oil will not cause the rubber insulation to deteriorate and cause short-circuiting.

Starter panel proper consists of a three-pole and a five-pole contactor mounted on a slate panel and interlocked to prevent them from both closing at the same time. The auto transformer and overload relays are mounted on a bracket at the rear of the panel. The panel is fastened to an angle iron frame which slides into channels at the sides of the tank, allowing easy removal of the panel.

ELECTRIC CONTROLLER & MFG. CO., CLEVELAND, O.

In the above illustration Fig. 6 is shown an outside view of a new across-the-line starter recently placed on the market by the Electric Controller and Manufacturing Co.

To make this starter especially quiet and efficient in operation, it is provided with a three-pole, E-shaped magnet on the center pole of which is mounted the moisture proof operating coil. The upper end of this magnet is half shaded. This design eliminates chattering and hum and produces a very uniform pole on the armature due to two additional fluxes on different phase angles, super-imposed upon and out of phase with the main fluxes produced by the line current.

Ordinarily these starters are tested and shipped with overload relays said to trip at 125 per cent full load motor current but when desired this setting may be changed to any value between 100 and 150 per cent by turning a small knob located on the outside of the relay cover.

RUGGLES-KLINGEMANN MFG. CO., SALEM, MASS.

Reversing type switch for use in control of electrically reversible motors such as required in operation of motor operated valves or other motor operated equipment in which a reversible motor is used, has been developed by Ruggles-Klingemann Mfg. Co., known as R-K Fig. 256; they are intended for use in either pressure or temperature control systems, or combination of pressure and temperature control.

One of the objects of this switch is to compensate for time lag in the system, thus preventing a condition of over correction and hunting action. A further object is to maintain a uniform condition of the system regardless of variation in the volume requirements. The distinguishing feature of this switch is that it operates in periods of from 1 to 5 seconds each, depending on the variation from normal and has a period of rest which

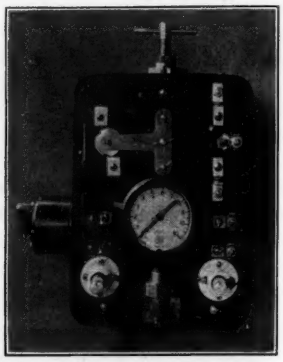


FIG 7. R-K FIG 256 EPICHRON SWITCH WITH COVER REMOVED

may be varied in accordance with variations in time lag in the system.

In cases where there is no time lag in the system, regulating equipment becomes self compensating from pressure changes, but where there is time lag to any extent, there must be some retarding action to prevent over travel resulting in over correction and so-called hunting.

In the construction of this switch, a small synchronous motor controls the timing of the periods of operation. At uniform predetermined periods this little timing motor feels out the circuit to see if there has been any variation from normal, and if so, then to make the necessary correction.

In opening the valve, the switch can operate only in periods of 5 seconds each, with a period of rest between each step of operation sufficient to allow the last period of operation to become effective at the switch before proceeding to a further opening of the valve. In closing, however, should the pressure or temperature exceed 5 per cent of the normal value the valve can be operated continuously until a normal condition is restored after which it will again operate by steps either opening or closing the valve as the condition of the system may indicate.

The pressure control switch is intended for operation of valves, dampers and rheostats for the control of steam, air, water, gas or oil pressure and may be supplied for pressure settings ranging from 0 to 150 lb. gage or for vacuum.

The temperature control switch may be supplied for any temperature setting ranging from 50 to 250 deg. F. and is intended for use in controlling motor operated valves in controlling steam supply to instantaneous or storage type of heaters or for damper operation in hot water heating systems.

In the combination pressure and temperature control switch intended for steam heating systems, the steam is primarily controlled from pressure, but the pressure setting may be modulated from temperature changes.

This switch can be adjusted to maintain a relatively higher pressure in the morning and as the room temperature increases the temperature control becomes active and modulates the pressure setting of the switch

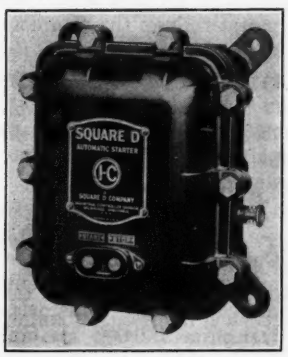


FIG. 8. (LEFT) SQUARE D CLASS 9001 TYPE BR-11 CONTROL
FIG. 9. (RIGHT) SQUARE D CLASS 8532 TYPE AR-1 AND BR-1 STARTER

maintaining a relatively lower reduced pressure, or if necessary closing the valve entirely.

SQUARE D Co., MILWAUKEE, WIS.

Class 9001 Type BR-11 explosion proof control station manufactured by the Industrial Controller Division of the Square D Co., has been approved by the Underwriters' Laboratory for Class 1, Group D, which comprises such hazardous locations as gasoline plants, dry cleaning plants, paint and lacquer plants and oil refineries.

This explosion proof control station is of the three wire, momentary contact type provided with one normally open and one normally closed contact enclosed in a cast-iron housing. It is so constructed that it will withstand an internal explosion without injury to the enclosure and without transmitting flames to the surrounding gases.

Class 8532, Types AR-1 and BR-1 explosion proof starters have also been approved by the Underwriters' Laboratory for use in similar locations.

Type AR-1 has a start-stop push button in the cover while Type BR-1 is designed for remote control. The starter mechanism consists of a ruggedly constructed three-pole magnetic contactor and thermal over-load relays mounted on a porcelain base. An explosion proof cast-iron enclosure surrounds the starter mechanism. The starters provide low voltage protection and release, also time limit overload protection to a.c. single and polyphase across-the-line motors.

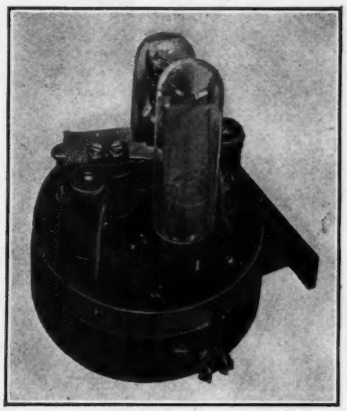
Electrical Equipment and Oil Reclamation

BURGESS BATTERY Co., NEW YORK, N. Y.

COMPLETE, READY-TO-USE light relay and light source units of extreme simplicity, ruggedness and reliability are now being produced and sold by the Radiovisor Division of the Burgess Battery Co.,

These light relay units are available in both alternating current and direct current models for use on usual power supplies. The units are in the form of an aluminum housing with window, containing a circular platform on which the bridge, tubes and other components are mounted.

As companion equipment, the Burgess light source units, available in alternating current and direct current models, are also offered. Each unit contains a 12-v. 21-candlepower bulb, as well as a focusing optical system to concentrate the light beam on the light-sensitive surface of the light relay unit. The light source unit is housed in an aluminum case similar to the light relay unit.



INTERIOR VIEW OF D.C. LIGHT RELAY

Requiring no other installation than wall or other mounting, and connecting with the usual electric outlet and the circuit to be controlled, the Burgess units are available for no end of light-control applications.

THE RELIANCE ELECTRIC ENGINEERING Co.
CLEVELAND, O.

Type T direct-current motors for vertical operation in sizes up to 50 hp., 1150 r.p.m. have recently been developed by The Reliance Electric Engineering Co. of Cleveland, O.

These motors are provided with a ring base for mounting and a drip cover to protect them from falling dirt and chips and from dripping water, oil or other injurious solutions.

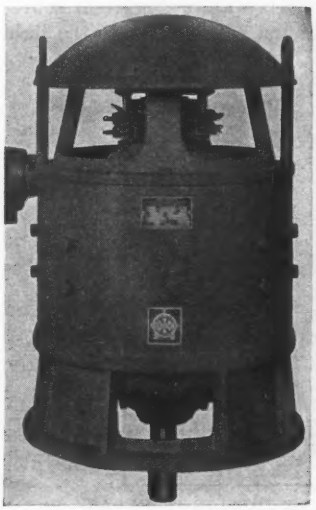
Where it is desirable, the motor can be mounted direct on the machine being driven, without the ring base, and will appear as an integral part of the machine.

Amply large bearings are used to take up the thrust load or weight of the armature. Two heavy eye-bolts are provided to make handling easy. In all other ways, the construction is the same as the Reliance Type T, direct-current, heavy-duty motor for horizontal operation.

The company has also developed a new line of small d.c. motors to supplement the company's larger Type T heavy-duty motors. These new motors are built in sizes from ½ hp., 1750 r.p.m. to 3 hp., 1750 r.p.m. for constant or adjustable-speed operation. Like the larger motors, they are ruggedly constructed to withstand hard service and unusual strains when necessary. They are provided with ball or sleeve bearings and may be had in either the open, semi-enclosed or fully-enclosed construction.

These windings are given a finishing coat of bright orange-colored enamel the same as the larger Type T motors to make it easy to detect and remove dirt. This decreases maintenance and prolongs the life of the motor.

A feature not usually found in such small motors is the refillable-type commutator. If the copper bars should ever become damaged or badly worn, they may be easily removed and replaced. Another unusual feature for small motors is the provision of two brushes per stud. This betters commutation and keeps these power units running longer and steadier with less attention.



VERTICAL RELIANCE MOTOR WITH DRIP COVER

FIG. 2. THE FINISHED RADIATOR

Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

The Westinghouse Electric & Mfg. Co. has announced a new surge-proof construction for high-voltage shell-type power transformers. Important improvements in the design of the insulation have been made which result in greatly increased impulse strength. Not only are surge voltages distributed uniformly throughout the winding in these new transformers, but, more important still, the winding and insulation are so designed that the voltage stresses in the insulation are substantially uniform throughout the entire insulation structure. The transformers are non-oscillating for all practical purposes, even with the longest possible surges produced by lightning.

Transformers of the new surge-proof type totaling over one million kv-a. are on order or have already been delivered. The new type of construction will be applied in the future to all large high voltage power transformers built by Westinghouse.

Two long strips of 1/20 in. thick steel, welded together around the edges and then "blown-up" by air pressure, is the ingenious way Westinghouse Electric & Mfg. Co. makes transformer radiators.

In the manufacture, a pair of flat steel sheets cut to the right shape are placed back to back and welded air-tight around the rim and then spot-welded down the center for strength before being deformed in any way. Automatic resistance seam welders do this work. This flat, air-tight metal bag is then placed between the retaining walls of a jig, and 90 lb. per sq. in. air pressure (corresponding to 500 per cent normal working pressure) inflates the steel shell to produce a light, rugged, cooling section. After welding, inflating and forming, several cooling sections are grouped into a common header to form the radiator, Fig. 2.

Great care is taken that the welds do not leak. The inflating air is a severe test itself, but the most trying ordeal follows the complete assembly when the radiator is stood upright and 80 deg. C. oil at 15 lb. per sq. in. pressure is circulated through it for 2 hr.

All welded surfaces are on the outside, where they can easily be inspected; parts are quickly cleaned and painted and there are no places on which water can stand.

Largest Synchronous Condenser

A 75,000 kv-a., 514-r.p.m. unit under construction for Commonwealth Edison Co. is larger by half than any other synchronous condenser ever built. It is to be connected through transformers to the 220-kv. line which transmits 150,000 kw. into Chicago (Crawford Ave. Station) from the Powerton Station 150 mi. away. The machine is 40 ft. long, 16 ft. in diameter and weighs over 300 tons. The main machine is fitted with a direct-connected 3750-hp. induction motor for starting and synchronizing, and for supplying voltage to the line during tests.

Correction Note

In the Nov. 15, 1931, issue, reference was made on the editorial page to installation of a dual electric equipment by Westinghouse Electric and Manufacturing Co. We are informed by Frank J. Sprague, president of Sprague Safety Control and Signal Corpn. that this should be known as the Westinghouse-Sprague elevator, since it is being developed under Sprague patent No. 1,763,198.

According to an announcement just made public by Fairbanks, Morse & Co., Robert H. Morse, formerly vice chairman of the Board of Directors, has been elected to the positions of president and general manager to succeed W. S. Hovey on his resignation, December 1. Robert H. Morse was born in Chicago, Ill., December 6, 1878. In 1895 he entered the employ of Fairbanks, Morse & Co., the firm founded by his father, C. H. Morse. Here he began his career as an apprentice at the Beloit factory (then known as Fairbanks-Morse Manufacturing Co.), and, except during his military service, when he was lieutenant-colonel in the Signal Corps, has been with the company continuously since.

Mr. Morse is also a director of E. & T. Fairbanks & Co., The Canadian Fairbanks-Morse Co. and Central Republic Bank and Trust Co.

EQUIPMENT *for the* PLANT ENGINEER

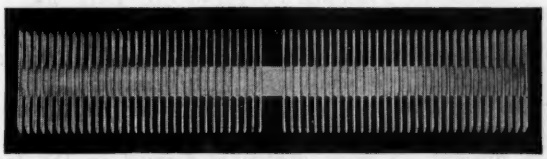
Heating and Ventilating

THE ALUMINOL PRODUCTS CORP., CLEVELAND, O.

AFTER EXHAUSTIVE TESTS, The Aluminol Products Corp., 320 Marion Bldg., Cleveland, O., has now placed on the market, a new type of evaporator unit for refrigeration work.

Use of "Aluminol" instead of the usual cast iron or steel pipe coils offers several important advantages. The weight of the "Aluminol" unit is less than one quarter that of a cast-iron or steel unit of equal radiating surface; the thermal conductivity is higher and being rustless, "Aluminol" needs no metal coating or galvanizing, to protect it against moisture.

Construction features also offer important advantages. Units are integrally cast in multiples of two, three, four or more. Internal construction is such that a definite amount of refrigerant condenses and is held in



NEW ALUMINOL EVAPORATOR UNIT

each Aluminol unit during the compressor shut-down period. When compressor starts up, evaporation immediately begins throughout the entire system, thereby giving a dry refrigerating system with the advantages of a flooded system.

THE BURT MANUFACTURING CO., AKRON, O.

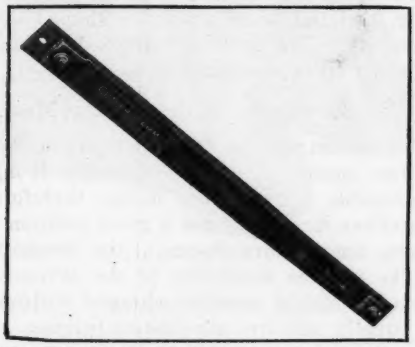
In the chart, Fig. 2, the Burt Mfg. Co. has attempted to show the immense benefits which can be obtained through the use of fan roof ventilators over ordinary gravity type roof ventilators. This company has nothing derogatory to say in regard to gravity type ventilators inasmuch as it manufactures that type of ventilator itself; however, their capacities are dependent upon wind velocities, height above intake, temperature differences and other variables which affect their exhaust capacities and adaptability for power plants or other buildings where a positive rate of exhaust must be maintained. For that reason, the modernization chart, Fig. 2, will benefit those who are interested in a comparison of the capacities of our new fan ventilators with those of an ordinary roof ventilator. To explain the chart in further detail, we have tried to show that a 24-in. fan

ventilator will replace approximately 7 ordinary 20-in., 5 24-in., 3 30-in. or 2 36-in. gravity ventilators.

CUTLER-HAMMER, INC., MILWAUKEE, WIS.

Space heater of new design, with heating element of nickel chromium alloy and a highly refractory granular compound used for insulation, is announced by Cutler-Hammer, Inc., Milwaukee, Wis. No cement or spacers are used, it is stated and, a new process of imbedding the element in this compound under immense pressure is used to make the new space heater immune to vibration and jarring.

The new heaters have a normal rated capacity of 500 watts. They are furnished for 100-125 v. and 200-250 v., either direct or alternating current. They are not subject to damage from even unusual voltage peaks, it is



SPACE HEATER WITH NICKEL CHROMIUM ALLOY ELEMENT

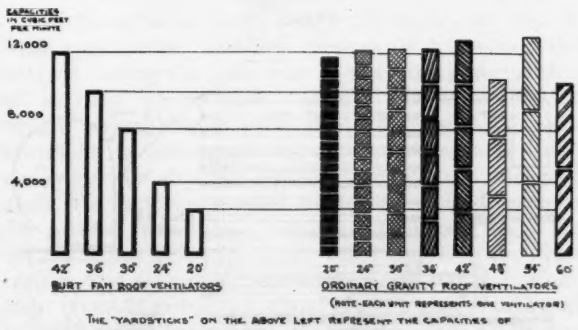

CAPACITIES IN CUBIC FEET PER MINUTE
12,000
8,000
4,000
42" 36" 30" 24" 20"
BURT FAN ROOF VENTILATORS
20" 24" 30" 36" 42" 48" 54" 60"
ORDINARY GRAVITY ROOF VENTILATORS
(NOTE-EACH UNIT REPRESENTS ONE VENTILATOR)
THE "YARDSTICKS" ON THE ABOVE LEFT REPRESENT THE CAPACITIES OF SEVERAL SIZES OF BURT FAN VENTILATORS. THOSE ON THE RIGHT SHOW THE TOTAL CAPACITIES OF THE NUMBER OF ORDINARY GRAVITY TYPE ROOF THAT EQUAL A SPECIFIC FAN VENTILATOR CAPACITIES.

FIG. 2. BURT VENTILATOR MODERNIZATION CHART

claimed, because of their exceptionally high overload capacity which is gained by the new method of construction.

THE ILLINOIS STOKER CO., ALTON, ILL.

New type of shop heating unit, a combination of a small chain grate stoker and a hot-air, forced-draft heating unit has just been announced by The Illinois Stoker Co. of Alton, Ill. The company's 50—250-hp. small chain grate stoker is used in this shop heating unit in connection with a newly-developed hot air unit through which air is blown by a standard 5000-c.f.m. blower.

Simplicity and effective heating range of this unit, it is claimed, make it unusually adaptable for heating of repair shops and other large open structures. This shop heater combines in one unit the automatic stoker, the heating unit itself and the means for distributing heated air throughout the interior of large open buildings.

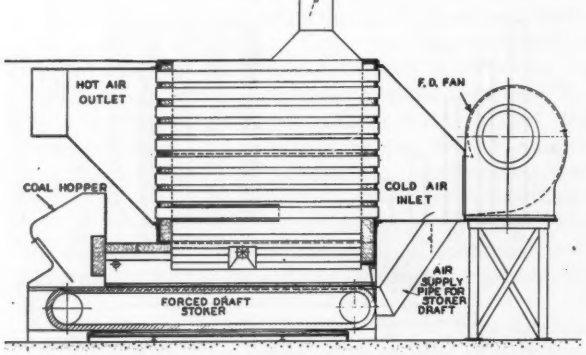
THE POWERS REGULATOR CO., CHICAGO, ILL.

The Powers Regulator Co. announces the addition of the Powers Thermostatic Radiator Valve to its already complete line of temperature regulators. This Thermostatic Radiator Valve is a self-operating regulator employing the same principle of operation which has been used so successfully for many years in thousands of Powers regulators, and is designed to control the temperature of rooms heated by direct, indirect or concealed radiation of vapor or vacuum heating systems.

This temperature regulator consists of a diaphragm operated valve connected by armored flexible tubing to a thermostat which can be obtained in two styles: one enclosed in a thermostat case with thermometer for wall mounting, and the other a tubular shaped thermostat of the bulb type for use with concealed radiation, unit heaters and wall type radiators.

THE SUPERSTAT CO., SPRINGFIELD, MASS.

The Superstat Co. has placed on the market a new temperature control called the Superstat. It is powered by a reversible squirrel cage motor, therefore it can move in either direction from a given position upon 1/8 of a degree temperature change at the thermostatic element. The extreme sensitivity of the device is due to the use of a highly sensitive charged hydron bellows and an equally sensitive air cushion bellows.



CHAIN GRATE STOKER, BLOWER AND HEATING UNIT COMBINED FOR SHOP HEATING

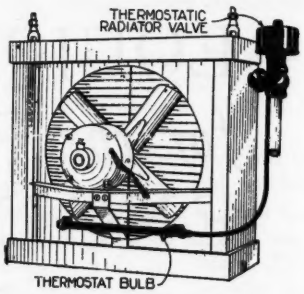


FIG. 5. POWERS THERMOSTATIC RADIATOR VALVE

The device is sold in two forms, a unit having an operating arm which moves through an arc of 90 deg. and a valve operating unit mounted directly upon a high grade whistle type of valve for complete closure, or upon a butterfly type for intermediate flow control. In both devices, the operative member has eleven operating positions within its maximum travel. There are six positions for rising temperature and six positions for falling temperature staggered with relation to each other, thus providing eleven operative positions of the valve or control arm.

Records from hot rooms, anthracite stokers and oil burners show an ability to control within 1 deg. F. total variation. The anticipatory reversing circuit in the thermostat eliminates the common fault of thermostats generally in overrunning their control.

Power Transmission Equipment

AMERICAN FLEXIBLE COUPLING CO., ERIE, PA.

Recent additions to the line of flexible shaft couplings, manufactured by the American Flexible Coupling Co., includes two small sizes with maximum bores of 3/4 in. and 1 in. and designated No. 4 and No. 6 respectively. Flange sections of the small American couplings are die-cast. A wide groove is formed in the face, leaving two jaws between which the floating center member slides, as shown in Fig. 1. The floating center member is a solid, non-metallic, self-lubricating piece and transmits the torque between the flange sections. The design is simple and the couplings permits comparative misalinements between shafts, without the use of springs, bolts, pins or flexible materials.

Power capacity is 0.05 hp. per 100 r.p.m. for the No. 4, and .15 hp. per 100 r.p.m. for the No. 6. The weights are 3/4 lb. and 2 lb. respectively. Both sizes permit a maximum parallel misalinement of 1/64 in. and a maximum angular misalinement of 1 deg. The standard flanges are provided with a single setscrew, but additional screws or keyways can be provided. As in the larger sizes, it is not necessary to dismantle the coupling in order to disconnect the driving and driven shafts.

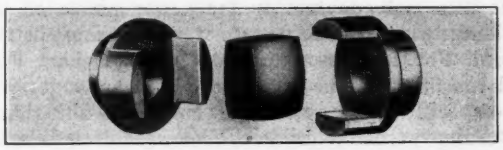


FIG. 1. AMERICAN FLEXIBLE COUPLING

FIG. 2. CLEVELAND TYPE AT SPEED REDUCER

CLEVELAND WORM & GEAR CO., CLEVELAND, O.

A recent addition to the series of standard worm gear reduction units manufactured by the Cleveland Worm & Gear Co., is designed to transmit up to about 7½ hp., the capacity depending on the reduction ratio and worm speed. The new size of unit is furnished in both horizontal and vertical types, and is designated size 70. The horizontal units are built with the worm below or above the gear, designated type AT or RT, respectively. In the type VT vertical the gear shaft extends upward, the gear shaft of the type VD extending downward. The type AT is shown in Fig. 2. In a range of nine standard ratios, varying from 45/6:1 to 60:1, the size 70 unit can be shipped immediately from stock. A list of fifteen special ratios is also available, the cost of a special ratio being slightly higher and delivery a little longer.

CURTISS & SMITH MFG. CORP., NEWARK, N. J.

Designed to remove easily and quickly any Timken or other anti-friction bearing without damaging the bearing, the dismounting press shown in Fig. 3, has been announced by the Curtiss & Smith Mfg. Corp. It is designed also to remove gears, spirals, pulleys, discs, collars, bushings or anything that fits tightly on a shaft and that can be removed either by a push or a pull.

To use the press the chuck is put on, using adapters if necessary, the press is attached and the press screw turned, thus dismounting the bearing with equally small pressure it is stated on every roller or ball. The press is made in several standard sizes and designs and can be arranged to pull as well as to push. Special designs can be furnished for special work.

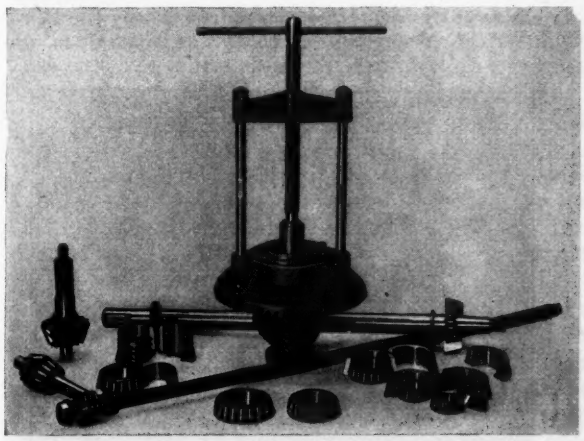


FIG. 3. CURTISS & SMITH DISMOUNTING PRESS

DAUN-WALTER CO., MILWAUKEE, WIS.

Constant level oil control for the regulation of lubrication for all types of machine bearings and ways has recently been placed on the market.

This device consists essentially of a main reservoir with gage to show the height of oil in reservoir, supporting bracket, threaded lower extension for oil lead connection and a filling cap on the top.

The oil may be piped in any horizontal direction and can feed one or several bearings on the same level; or in connection with D-W special adjustable wick unit, single or multiple bearings on different levels can be accurately fed. The control is made with oil reservoir capacities ranging from ½ pint to 2 gal. It is a product of the Daun-Walter Co.

FIG. 4. DE LAVAL REDUCING GEAR

DE LAVAL STEAM TURBINE CO., TRENTON, N. J.

De Laval worm reduction gears, shown by Fig. 4, with anti-friction bearings throughout have been developed during the past year to meet the requirements of services where such bearings are preferable, or equally as suitable as plain sleeve bearings. All parts are made to limit gages on an interchangeable basis, and when anti-friction bearings are used on the gear shaft, the latter is ground with the proper tolerances for pressed fits. Single reduction gears are made for bottom or top drive, the latter being shown in the illustration, and for ratios from 4 to 1 up to 100 to 1 in one step. Double reduction gears cover higher ratios, up to 8000 to 1. Ordinarily, the worms, gear teeth and bearings are oiled by splash lubrication, although forced lubrication and artificial cooling are provided in special cases.

F. A. B. Mfg. Co., Oakland, Cal.

An improved type of flexible coupling is announced by the F. A. B. Mfg. Co. The new coupling, in addition to compensating for parallel and angular misalinement, or combinations of both, embodies a shock-resisting feature and method of eliminating vibration. No lubrication is required and the improved coupling will operate noiselessly at 3450 r.p.m. It is being manufactured in sizes up to 1200 hp.

Ingersoll-Rand Co., New York, N. Y.

Ingersoll-Rand Co. has added to its line of portable hoists a non-reversible, single-drum electric hoist designed for many applications in the mining, contracting and industrial fields. It is modeled after the company's Utility hoists, except that it uses an electric motor and friction clutch instead of an air motor and a jaw clutch.

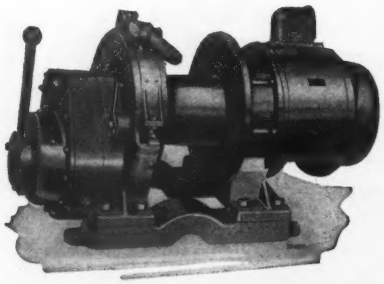


FIG. 5. INGERSOLL-RAND PORTABLE HOIST

The new hoist is suitable for all single cable work within its capacity such as hoisting timbers, muck, tools and pipe, hauling and spotting cars, and for single-line scraping. It is made in two sizes. No. 107 is of 7½ hp. and rated at 2000 lb. pull at 125 f.p.m. It has drum capacity for 400 ft. of ½-in. or 700 ft. of ⅜-in. cable. No. 107L is of like power, but has drum capacity for 800 ft. of ½-in. or 1400 ft. of ⅜-in. cable. No. 110 has a 10-hp. motor and is rated at 2000 lb. pull at 165 f.p.m. The drum capacity is the same as for the No. 107. No. 110L has the same power as the No. 110 and the same drum capacity as the No. 107L.

The Lunkenheimer Co., Cincinnati, O.

New type of wick oil cup called the "Glaswick" oil cup designed to provide automatic lubrication, visibility of oil supply, maintenance of constant oil level with consequent uniform feed and ease in replenishing the oil supply, is being marketed by The Lunkenheimer Co., Cincinnati, O.

This oil cup has a capacity of approximately 4 oz. of oil. It consists of a steel cup with a shut-off cock in the shank and a glass bottle which fits over the top of the cup. The bottle is held securely to the cup by a steel wire and clamp. Tight closure between glass bottle and steel cup excludes dirt. The steel cup is filled with oil. The glass bottle is also filled and inverted over the cup. Oil visible in the glass bottle shows that the cup is full and that the wick is absorbing sufficient oil to insure a constant uniform feed to the bearing.

Desired rate of feed is obtained by determining the number of strands of wick to be used; the oil then feeds at a uniform rate, it is stated, and the cup needs no further adjustment.

FIG. 6. BOTTLE AND CUP OF GLASWICK OIL CUP HELD TOGETHER BY SPRING

The cock in the shank permits shutting off the flow when the bearings are idle, making it unnecessary to remove the wicks to stop the feed. Further, it provides an accumulation of oil to flush the bearing when the cock is opened. After the accumulated oil runs out, the Glaswick feeds at the predetermined rate.

Murray Iron Works Co., Burlington, Ia.

The Murray Iron Works Co. announces the development of high speed, herringbone gears suitable for use in connection with generator, pump and fan drives with motors, steam turbines or oil engines as drivers.

Gears of this series, Fig. 6, are particularly free from noise. So, for example, with generator drives the gear noise is generally less than the brush noise of a d.c. generator. This is accomplished by special methods of hobbing and through special mechanical construction of the sets.

These gears are suitable for speeds from the lowest up to 5000 r.p.m. and horsepowers from 100 to 3000. They are made in double or single reduction units. They have complete lubrication and cooling system, the gear faces being lubricated by means of oil sprays and the bearings having forced lubrication.

Reeves Pulley Co., Columbus, Ind.

Vari-speed motor pulley, shown in the accompanying illustration, is a new type of variable speed unit directly mounted on the motor shaft to form the driving element between the motor and the driven shaft. It has recently been placed on the market by the Reeves Pulley Co., Columbus, Ind. It is designed to give

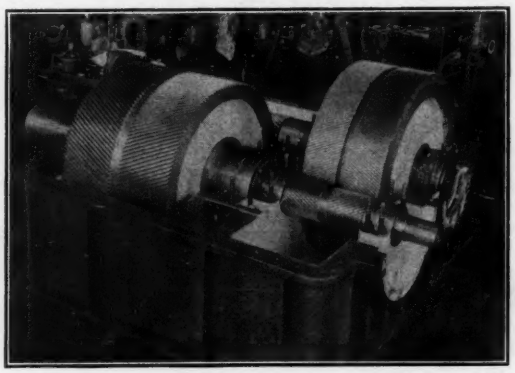
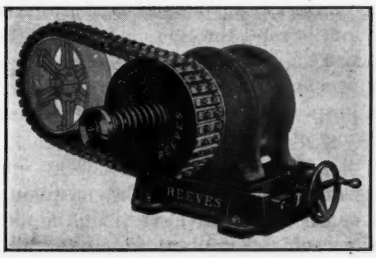


FIG. 7. MURRAY HERRINGBONE GEARS

speed control in infinite steps between a ratio limitation of 3 to 1, for horsepower ratings from fractional to 7½.

The vari-speed motor pulley consists of an assembly of two opposing cone-faced discs, one stationary and one sliding, and an adjustable power compression spring, the whole self-contained and mounted on the motor shaft; a special motor base with adjusting handwheel, by which the motor may be moved forward or backward; a special type of V-belt designed to contact on its sides between the cone-faced discs and on its flat surface over the driven pulley. Any type of straight face pulley—wood, metal or paper—may be used on the driven shaft.



DESIGN OF SIZES FROM 1 TO 7½ HP. INCLUSIVE

When the motor is at the position on the special motor base nearest to the driven shaft, the V-belt assumes the largest diameter formed by the cone-faced discs and the maximum speed is obtained on the driven pulley.

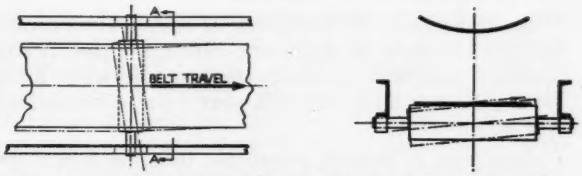
By turning the handwheel, the motor is moved away from the driven pulley. This causes the V-belt to assume a smaller diameter between the cone-faced discs, the sliding disc moving laterally, but held in contact with the V-belt by the compression spring. Thus the speed of the driven pulley is reduced. When the motor is moved to the position farthest away from the driven shaft, the V-belt assumes the smallest diameter, and the minimum speed is obtained on the driven pulley.

ROBINS CONVEYOR BELT CO., NEW YORK, N. Y.

Accompanying illustrations show the action of a belt trainer recently placed on the market by the Robins Conveying Belt Co. of New York. This device is designed to make the belt run straight. It is used on the return strand of a belt conveyor where the belt is not troughed and where a few of these devices substituted for return idlers will keep the belt running straight.

The belt-trainer consists of a tubular roller mounted on a single anti-friction bearing at its center, this bearing being internally pivoted upon a fixed swivel pin located on the center line of the conveyor and inclined forward about 30 deg. The roller is free, therefore, not only to rotate on the bearing but also to rock about this pivot.

The belt-trainer is designed in this way so that when the weight of the belt falls more on one side of the pivot than upon the other, the roller rocks downward on the heavy side. At the same time, because of the inclination of the swivel pin, the roller will move forward on the down-side and backward on the up-side, thus becoming skewed with relation to the belt. The object of this is to cause the belt to move back to the conveyor center-line. The belt-trainer does not oscillate continually but assumes a stable position, it is stated, and the belt finds its central position and runs true. Under normal conditions, one belt-trainer may be substituted for every eighth return idler, or about every 80 ft.; but under adverse conditions, it may be necessary to use one belt-trainer



LEFT—TOP VIEW OF RETURN STRAND OF BELT SHOWING ACTION OF BELT-TRAINER; RIGHT—VERTICAL ACTION OF BELT-TRAINER

about every 50 ft. The belt-trainer is made for all belt widths from 12 in. to 48 in. and is interchangeable with Robins standard return idlers.

WESTINGHOUSE ELEC. & MFG. CO., PITTSBURGH, PA.

Micarta, a phenolic resinous material, has been used as a bearing liner in wire, rod, bar and merchant mills, where the pressures are not excessive and the peripheral speeds vary from 100 to 1000 ft. a minute. A bearing of this type is shown.

Water alone is used as a lubricant without any change in the conventional cooling system. Impure water, containing weak acids and alkalis, has no effect on Micarta and may be used without damage to the bearing, according to its maker, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. In addition, the characteristics of the bearing material reduce scoring and seizing to a minimum.

Three essential parts of the bearing are radial segments, thrust block, and housing. The radial segments usually are 120-deg. pieces so constructed that the wear at any point is at right angles to the grain of

ASSEMBLY OF MICARTA BEARING

the material. The thrust block consists of a separate piece of Micarta so mounted that maximum life is afforded since the edge of the roll rubs against the grain. The thrust block and radial segments are assembled in a machined housing and are held tightly in place. The thrust collar is prevented from turning by a recess machined in the metal housing. Either the thrust collar or radial segments may be replaced independently without any special machine setup. Distribution channels are machined in the bearing surface in order that proper cooling and lubrication are afforded.

Editorial Comment

The March of Progress

As we pause at the beginning of each year to review the progress made in equipment during the past twelve months, it is difficult to realize that the high water mark left by the last flood tide will next year be obliterated by a larger wave.

Last year it seemed impossible that the year's developments could be exceeded. Yet this year we have 1000-deg. temperature steam, 1800-lb. industrial pressure, a 110,000-kw. industrial turbine, a new 80,000-kw. plant with one turbine and one boiler and a thousand and one less impressive although none the less important developments.

Each year we top a range of mountains only to see in the distance another range to be climbed next year. In the fog and haze beyond that range lie higher and higher ranges to be climbed in coming years. Back of us lie lower ranges which have been surmounted and forgotten. Many times the back trail can be studied to advantage when difficult places in the trail are encountered. Unfortunately, however, the eyes of the majority are fixed ahead and each problem is a new one to be solved independently. One of the purposes of the review in this issue is to make available, for those who will break trail in the years to come, a record of what has been accomplished this year.

The main purpose, however, is to bridge the immediate gap between manufacturer and user. Of necessity the manufacturers break the trail, travelling far ahead into the realm of development. What they develop this year will be used generally for the first time by the wide awake engineer next year.

Because of the wide range of developments and their importance, it has been necessary this year to devote an entire issue to this important subject. Of necessity, statements have been made brief but their brevity should not be interpreted as a measure of their importance. Complete information and data will be gladly supplied on any piece of equipment or development which is of particular interest to readers. We hope that this will prove a valuable addition to the last issue dealing with the important topic of plant rehabilitation.

Duty and Beyond

In this day and age, there is a tendency to go as far as duty demands and leave the rest for the other fellow to carry through. Fortunately a few individuals go farther than this and to them we owe the progress that is made from day to day and year to year.

The power engineer is hired to keep the plant operating in a continuous and efficient manner. If he operates this year a little bit cheaper than last year, he is a capable, efficient fellow who will probably find an extra five a month in his pay envelope each year and some day walk into the plant to discover he is working under some up and coming young chap who has been brought in to build a new plant. It is one thing to show a decreased operating cost each year but it's sometimes difficult to explain why, although power is costing less than it was five years ago, the fuel bill is twice what it is at a competitor's plant with some two-thirds the manufacturing capacity.

The modern engineer must go farther than duty, he must be interested enough so that his enthusiasm will carry him beyond the line of duty into the exploration of dozens of possible schemes. An investigation of all new equipment, an inordinate curiosity in the neighbor's plant, especially if it is in another industry, and a mental fitting of everything new into his own plant is an attribute of the successful engineer.

Because of changing conditions, no plant is perfect. Still each engineer should have in his mind or preferably on paper, an ideal plant which for his conditions could not be improved upon. Sooner or later the opportunity to use that ideal plant will come up and the man on the job, familiar with local conditions, is the one in the best position to present the project.

Unfortunately, however, opportunity often finds him napping and finds it necessary to go to a consulting engineer for a survey to find out the information the engineer should have available, for his own information and satisfaction even though not part of his direct duty.

A survey by an outside consulting engineer should be made always before embarking on a program of major construction. To a good engineer, this should be merely a check or rather a culmination of his thought and study. To the mediocre or even average engineer, it is all Greek, something beyond the duty which he is paid to perform. Investigate the gap between a good and mediocre engineer and find out what an interesting and productive field it is.

Off Duty

The railroads, everybody informs us, are going to the dogs. They are on their last legs, so to speak—their goose is cooked and it is merely a matter of time before they, along with short selling, the independent grocer, the power trust and the Republican party will have been relegated to oblivion. Pipe lines, airplanes, pneumatic tubes, barge canals, motor buses, tin lizzies, privately owned and heavily mortgaged and other similar products of man's genius, the prophets tell us, will take their place and the country once again will be safe for this democracy or what have you.

Now, it is not our purpose, here, to argue this question but we have a sneaking suspicion that these prophets are of the same species that, in 1929, predicted permanent prosperity and the end of the business cycle and that despite the unfair competition and meddling of governmental agencies, the railroads may manage to retain their strangle hold on the life blood of the nation for some time to come. Indeed, this phase of the railroad situation doesn't interest us a great deal.

There is, however, a more fundamental factor, which while it does not spell the doom of the railroads, nevertheless will influence their character greatly. This is electrification. Electrification of railroads undoubtedly is a decided advance in their progress and represents the final stage in their evolution but we dislike to see it come, for it marks the passing of an old friend of ours, the steam locomotive.

Already the steam locomotive has disappeared from important stretches of main line track. On the New York, New Haven and Hartford, it has disappeared as far as New Haven and work is now in progress to eliminate it from the Pennsylvania from New York to Washington; indeed, if reports are correct, it will not be long before it will disappear as far west as Pittsburgh. Out west, it has given way to the electric locomotive on the mountain divisions of certain roads.

All this, perhaps, is very fine; but to many of us, it is stark tragedy. To those of us whose inland boyhood overlapped the division between the nineteenth and twentieth centuries, the steam locomotive will always have a deep fundamental attachment, and we cannot regard its passing without a feeling of deep emotion. There is something about the steam locomotive that inspires and impresses as no other machine on earth can. It is more than a machine—it is something that seems to live. There has been much discussion on the possibilities of scientists creating life in the laboratory. Undoubtedly this will be accomplished but thus far, the steam locomotive is the nearest approach to a living thing that man has devised. Most of man's mechanical creations are mere monsters of speed, or efficiency, or ingenuity. The steam locomotive alone has a sort of kinship with warm blooded creatures. It belongs, says H. L. Mencken, to that noble company of massive and gorgeous creatures, the elephants and whales, the mastodons and behemoths, the ceratopsia and sauropoda. There is something fearsome and prehistoric about it; it is nearer to the dinosaur than any living animal.

It is easy to understand why trainmen sometimes talk of engines as though they were alive, and it is easy to understand, also why they have such affection for them. Indeed, who has not experienced a sort of sympathy for one of them, laboriously toiling with its heavy burden up a long grade in the mountains, its bowels filled with fierce benevolent anger? They seem to take a conscious pride in their endless labors for mankind. Sometimes they seem actually tired and glad to rest. Often in passing through the trainshed at the railway terminal, you will find an engine breathing—panting quietly at the end of its long journey—a deep tranquil tsoo-tsoo, tsoo-tsoo, that seems almost human. You are tempted to speak to it, to thank it for its faithful service, but you never feel that way towards an electric locomotive.

As James Norman Hall expressed it recently in an article in *Harpers,* there must be a great many people who feel this way about locomotives—people who have what might be called a steam engine outlook rather than a gas engine outlook upon life. The railroads played a fundamental role in the development of this country and those of us who grew up during the period of their expansion will always remain loyal to trains.

There are adult people alive today, men and women in their twenties, who have never ridden on a train. It is quite possible that such people are happy and they may be perfectly content to do all their travelling in automobiles but to us it seems that they have missed a great deal in life. For a train to us is more than just a machine for transport—it is the symbol of an age, the basis of a philosophy, an expression of the grandeur of the country. It awakens thoughts of majestic distances, of diversity of climates, peoples and landscapes. These people who have never ridden on trains can never experience the same thrill that we, who have a passion for trains, get when on a drowsy summer afternoon we hear the whistle of a transcontinental flyer reverberating among mountain fastnesses of the continental divide, or coming across to us in the still winter air of the prairie country. Nor can they know what we feel when we hear the whistle of the midnight flyer, as it thunders down the grade; of the memories its varying tones invoke as they grow fainter and fainter.

Engineers invented the locomotive whistle, but engineers are often poets at heart and by some subtle combination of alchemy and poetic understanding, they seem to have put something in the locomotive whistle that never fails to strike a responsive cord in our deeper nature.

Other forms of transportation can, undoubtedly will, take the place of the steam locomotive, but none can ever take its place in our hearts, nor will any other machine of transport affect our emotions as does the locomotive. When one stands alongside the railroad as it thunders by, breathing fire, belching forth its acrid smoke, every sense is arrested and excited—it strikes terror to our hearts, it stuns the mind; there is nothing like it on the face of the earth. Even its odors have the power to fascinate. To many of us, as we pass by the locomotive at the end of a journey, the mingled smell of hot oil, steam and coal smoke is strangely sweet for the fragrance of our youth is in it. It arouses our emotions as does the smell of the sea in others. To quote James Norman Hall again, one has only to compare this odor to the acrid stench of the internal combustion engine to appreciate at once the world of difference in romantic appeal between a railroad train and a motor car. We are glad that in our generation at least there will be steam locomotives.

Yearly Index

INDEX for Volume XXXV of Power Plant Engineering is now prepared and will be sent free to subscribers upon request.

Progressive owners of power plants maintain that good housekeeping is one of the most effective means of proving the company's interest in the safety of its employes. A neat, orderly plant not only stimulates carefulness on the part of employes but enables the operations to be carried out more efficiently. In order that tools and working materials may be kept from obstructing walkways, stairs and ladders, provision must be made for storing such equipment where it can readily be secured when needed. Waste containers conveniently located and marked aisle spaces on floors are aids in housekeeping. Other features which foster safety are attractive grounds around the plant, freshly painted buildings, frequently cleaned walls, windows and floors. The general psychological effect of clean, carefully kept surroundings is to cause people to pay more attention to details of their work and safety follows as a result of this careful attention.

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